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EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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The Chicago office of the Railroad Gazette has been moved to 375 Old Colony Building. It is connected with the office of the Master Mechainics' and Master Car Builders' Association, and with the library of the Western Railway Club.

By a vote of five to four, the United States Supreme Court has reversed the decision of the New York Court of Appeals in the Lochner case, and declares the New York statute limiting the hours of labor to ten hours a day and sixty hours a week in the bakery and confectionery trades to be unconstitutional. The decision is important because it differentiates the police power of the commonwealth from the ordinary contract right of the individual. It is considered a valid exercise of the police power to limit working hours strictly in occupations which are dangerous to health, such as mining, and in industries where child labor is affected. But the court did not consider the baker's trade a dangerous one; it saw no reason, on grounds of public policy, why bakers should not work long hours, and it based its decision on the liberties guaranteed to the individual under the Fourteenth Amendment. The liberty to buy and sell labor, free and unrestrained, is included among these rights, subject only to curtailment by police power for the protection of the public. It is quite conceivable that there may be much honest difference of opinion as to how far this public protection should extend, but the decision of the court makes it clear that statutory restriction of the hours of labor must rest on other grounds than those of trade union expediency.

A few weeks ago—while low thermometers still ruled—an eastern newspaper printed an item on a familiar subject somewhat as follows:

Dissatisfaction is said to exist among the trainmen of the A. B. & C. road, over an order which has been issued requiring them to ride on the outside of freight trains from one end of the division to the other. The men claim that this in inflicting an unnecessary hardship in cold weather. For some time past there has been a general rule requiring the trainmen to keep on the top of the trains while making runs, but the rule has never been rigidly enforced. With a temperature near the zero mark and the trains going at thirty or forty miles an hour, the trainmen have made a practice of seeking shelter in the caboose or engine cab. The order now posted forbids this practice and instructs the two brakemen to ride on the top of the cars in view of the engineer and conductor at all times. The men will make a protest. An officer says that the reason of the issuing of the order was a recent accident. The trainmen were riding in the caboose. Several cars on the rear end of the train broke loose and the engineer did not miss them, and the cars were left behind and were struck by another freight, causing a slight wreck.

We call the subject a familiar one because orders of the same tenor as this have been issued, with more or less frequency, for the past fifty or sixty years. In some quarters there has seemed to be a regular sequence of orders, obedience, partial obedience, disobedience, disaster; orders, obedience, partial obedience, and so on. The somewhat similar process in "jacking up" the conductors on the rule forbidding them to carry deadheads without passes seems to have been successfully ended; why should not this be ended also? That any order, on any subject, needs to be reissued because it is disobeyed is a defective theory which ought to be "stamped out," for a very little trial will show to any one how much better it is to bring the men up to a rule instead of taking the rule down to the men; but the riding-on-top-of-the-train rule can now be settled on a more rational basis than formerly, because of the change that has been brought about by the introduction of the air-brake. For what are men needed on top of trains? If the air-brake is working, they are needed only as lookouts, evidently. Are they worth their wages for that purpose? (In this particular case the real fault was failure to go back with red signals, a matter which could not be affected by the presence or absence of men on top.) In witer the superintendent who thinks that he needs lookout-men must also ask himself whether he has the persistency to enforce his requirement, year in and year out. The rule that one man at a time may go forward or back to warm himself usually works out the other way; only one at a time stays out; and the 1 may soon be reduced to 0. If the rule be treated as a summer rule, on the theory that in warm weather it will require neither money nor special attention to secure the benefits of lookout men, there is the liability that the men will assume that a rule suspended by the company in winter can be safely suspended by themselves in summer. What is the difference between your road and the roads of those companies which for several years past have got along with one brakeman to a train, and that one usually on the engine? If there is not a marked difference between one road and another, how can you show a need for men on top of the train?

At a recent meeting of the Engineers' Society of Western Pennsylvania, Mr. F. S. Rice, in a paper presented, called attention to a much-disputed point in bridge design—the effect of expansion—and in the discussion which followed some interesting cases were cited where provision for expansion had been omitted in long bridges without noticeable effect on the strength or rigidity of the structures. Most bridge specifications contain a clause stating that the allowance for expansion shall be an inch in 100 ft., which corresponds to the standard coefficient for steel through a range of temperature of 129 deg. Fahr. Such a range of temperature is not at all unusual in northern climates, but it is more than doubtful if any measurements have ever been made on long spans which show a movement of even a small fraction of an inch. An examination of old bridge seats having either roller bearings or flat plate bearings usually shows that the bearings have rusted together and have had no movement whatever over each other. The elaborate bearings put under cables at the tops of suspension bridge towers show little if any signs of displacement after a few months, and in a long suspension bridge the expansion is usually considered a more seri-

ous obstacle to overcome than in truss bridges. We know that steel does expand under a rise in temperature, and if that expansion is constrained, internal stresses are set up in the metal. The question is, in what way do these internal stresses distribute themselves in a long bridge if no movement at the ends takes place? If the effect is not harmful, then there is no necessity of putting in complicated and expensive expansion bearings on the chance that they may allow some slight movement for a short time after the bridge is put up. It is not difficult to determine theoretically, from the modulus of steel, the amount and direction of expansion stresses for any range of temperature, but in this respect theory and practice do not agree. There is an unknown amount of flexibility in the piers and foundations of a bridge, and an equally uncertain amount of play in the joints of the bridge itself, which undoubtedly relieve the expansion stresses to some extent, for otherwise, under the combined load stresses and expansion stresses for an extreme range of temperature, the metal would be strained beyond its elastic limit. Some patient and careful investigator should find a fine opportunity here to settle a perplexing problem which has been the subject of much controversy.

THE MUHLKER CASE.

The decision just made by the Supreme Court of the United States in the suit of Muhlker against the New York Central will be found upon examination to extend further than the first thought suggests. Any case which in substance upsets three successive, deliberate decisions of the Court of Appeals of New York, delivered at intervals during the past five years, is from any standpoint important as well as interesting. And where the consequences reach far and wide, as they seem to do under this decision, more notice than a paragraph in the news column is required.

The facts of the case introduced questions involving constitutional principles familiar, but none the less valuable, to the humblest citizen. Mr. Henry Muhlker owned apartment property at the corner of Park avenue and 115th street, in the City of New York, which he claimed had been seriously damaged by the elevated structure upon which the New York Central runs its cars in Park avenue. His action was brought against that company to recover those damages, and the Supreme Court in the City of New York, where the trial was had, took his view of the case, at least to the extent of awarding him substantial damages. An appeal to the Appellate Division of that court brought an affirmance of his judgment, but the Court of Appeals, the tribunal of last resort in the state, reversed the judgment, and Muhlker then went to the Supreme Court of the United States. The result we now have before us.

In order to facilitate carrying out the Act of Congress, passed in 1890, which directed the Secretary of War to cause the bridges over the Harlem river to be replaced by others, permitting vessels to pass under them, the New York Legislature two years later passed an act to regulate and enlarge Park avenue, in the City of New York, to change the grade of the New York & Harlem Railroad, and to elevate the railroad structure on that street. To accomplish this work, which was begun in 1894, the law created a board of experts and imposed upon it the duty of making the plans, letting the contracts, employing and discharging labor without supervision or interference by the Harlem River Railroad Company or its lessee, the New York Central, which had previously used the street for many years. One-half of the expense was imposed by the statute upon the railroad companies and the other half upon the City of New York.

Prior to the changes thus authorized the railroad tracks in front of the Muhlker premises were laid in a cut bounded on both sides by walls of masonry three feet above the surface of the avenue. A change of grade north of 125th street became necessary in order to cross the Harlem river at the height required by the Federal law. During the progress of the changes required by these laws, the New York Central operated its trains on temporary trestle work outside the lines of the permanent tracks. The new structure was an elevated steel viaduct considerably higher than the old, and permitted free communication under the tracks at grade by way of the cross streets and also from one side of Park avenue to the other, which was not possible under the old structure. It will thus be seen that while the avenue was greatly improved, from a public standpoint, and the changes benefited the Muhlker property to the extent of freer communication from different points, the increased altitude of the new viaduct diminished light and air, and, during the progress of the work, access to the property.

Both the trial court and the Appellate Division found this damage was substantial and fixed the amount accordingly. The doctrine upon which the court based this damage was in a modified degree that of the elevated railroad cases, and the principle of those cases was first applied as to the Park avenue structure in the Lewis case, decided by the New York Court of Appeals in February, 1900. That case granted the abutting owner damages, not for the construction of the new viaduct, but for the use of it by the railroad company. The court there held that the changes in the avenue were made for the benefit of the public at the instance of the state by a governmental agency, and that the railroad companies having no authority or control over the work could not be responsible for it; that if the defendants had never used the viaduct they would never have been liable for damages, but their liability began with that use and continued therewith, notwithstanding the statute authorized and directed the companies to use the tracks on the viaduct when completed.

The liability in the Lewis case was twofold: first, for the use of the temporary side trestle, which was held to be a new burden upon the street, and after that, for the permanent use of the viaduct, which deprived the owner of his easements of light and air. All the judges of the court hearing the argument concurred in the decision, and the bar had supposed that the law was thus settled on the subject. A number of suits were brought under this case and judgments were rendered in conformity to the principles thus laid down.

Among these plaintiffs was Fries, the owner of a building on the corner of Park avenue and 129th street, whose damages, assessed by the trial court, were approved by the Appellate Division, which held that the viaduct and the operation of the trains thereon constituted a continued trespass on the easements of light and air appurtenant to the plaintiff's property. The railroad companies, restive under the prospect of the heavy liability imposed upon them by the Lewis case, made another effort to induce the Court of Appeals to change its opinion and for this purpose carried the Fries case up on appeal. Strange to say, in this effort they succeeded. That tribunal, with rare conscientiousness, being convinced it had erred in the Lewis case, reversed itself and held that the defendants were liable neither for the construction nor the use of the new viaduct.

This reversal was based first upon the doctrine long embedded in the jurisdiction of New York that a change in the grade of a street by the public authorities, if done with ordinary care and skill, can impose no liability upon the state nor the municipality, notwithstanding damages may result to the abutting owner, and secondly upon the equitable principle that as the work in question was done by the state and the substitution from the lower to the higher viaduct was made in pursuance of its authority which the railroad companies were obliged to obey, they could not be held responsible either for the change or the subsequent permanent use rendered necessary thereby. Whatever one may think of the soundness of the first proposition, the second is most reasonable and just. The weak point in the Lewis case was in holding the companies not liable for erecting the structure and yet liable for using it when both erection and use were authorized and enforced by law.

The decision in the Fries case was not unanimous. Four of the judges were arrayed against three. Judge Cullen delivered the dissenting opinion, in which he candidly admitted that it was difficult to justify the distinction in principle, between two rules of law prevailing in this state, one of which declares that raising the grade of a street and building a bank of solid filling opposite an abutter's premises gives no right of action, and the other, which holds that the erection of an elevated railroad is an invasion of his property rights entitling him to damages. But the learned judge admitted that these rules, inconsistent as they seemed from the standpoint of principle, were irrevocably fixed in our judicial system. He held that the legislature could not authorize the construction of a viaduct for an elevated road unless compensation be made to the abutter. He conceded that the legislature had power to authorize the improvement of Park avenue, and to direct a railroad company to elevate its tracks, but he denied its power to release either the commissioners or the railroad company from paying for any private property taken for the improvement.

About two years later the Muhlker case reached the Court of Appeals, and was decided in February, 1903. Here the court adhered to its decision in the Fries case. Four of the six judges concurred in the prevailing opinion, while Judges Bartlett and Cullen dissented. The doctrine of the Fries case was confirmed, and the court held the defendant railroad companies free from liability to Muhlker on the ground that the structure

was ordered by the state for the benefit of the public, and that any damage consequent upon the use of it was wrought not by the companies but by the state, and by the settled law the state could not be called upon to respond in damages.

Here we seem to find the error in the argument. For there seems to be no difference in principle or in effect whether the state itself takes private property or authorizes some one else to do so, the state being held free of liability, while its appointee is made liable. In either case the source of authority is in the state and the public use without compensation is just as vicious in principle and damaging in fact when exercised by the state as it is when exercised at the instance of the state. This at least was the view of Mr. Muhlker, for he promptly carried his case to the Supreme Court at Washington, and has just secured a reversal of the judgment of the New York Court of Appeals.

The Supreme Court first ascertains that the law of New York, as settled by the elevated railroad decisions beginning with the Storey case in 1892, recognizes the right of an abutting owner to light, air and access as easements appurtenant to his premises. Starting from this acknowledged principle, the Supreme Court plants itself upon the Constitution of the United States, which prohibits the taking of private property for public use without compensation, and as the record showed that these easements of private property had been taken from Muhlker by the erection and operation of the structure without compensation, the act was void as to him, whether perpetrated by the state or by the defendant companies.

This case seems to deliver the death blow to that monstrous proposition which has battened so long upon the vital of property owners; the proposition that the public authorities under the guise of changing grades and regulating streets may take property for public use without the slightest redress, on the ground that it is an inconvenience imposed by the social compact, and that one must bear his loss with philosophy and the consolation that he is suffering for the benefit of the public. If the doctrine be true that this improvement was ordered for the public welfare, it should be paid for out of the public purse, and neither the railroads nor private owners should have been called upon to bear the expense as they have been. What redress the railroads will have against the state, after paying these claims, is another phase of the case which will doubtless receive their attention in due course.

March Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of March, printed in another column, contains accounts of 26 collisions, 30 derailments, and three other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Killed.	Injured.
3d. Clifton, Pa.	8	35
4th. Clarksville, Tex.	2	1
5th. Bearmouth, Mont.	2	20
10th. Pittsfield, Pa.	1	6
15th. Waldron, Ark.	1	4
19th. Winfield, Ind.	0	12
21st. Homestead, Ia.	0	6

The Clifton collision was reported in the *Railroad Gazette* of March 10, pages 195 and 199, and the chief elements of the cause were there discussed. No further light has been thrown on the cause. The engineman is reported as saying that he "was going very fast and it did not seem as though there had been time to reach the next signal"; but to most superintendents this will sound like an explanation manufactured to disguise the main point—the point that to save time the engineman habitually ran too close to adverse distant signals. A part of the mystery is cleared up by the statement that the rear car of the standing train was *not* 1,000 ft. beyond the home signal, as was asserted in some published accounts. The question of the merits of the three-position signal does not seem to be affected in any way by this accident. The engineman does not try to throw any part of the blame on the signal, and it does not appear that he behaved any differently from what he would have done if he had been running on a line equipped with the usual home and distant arms on the same post. He says that he passed the Dixmont signal (2,874 ft. before he reached the Clifton signal) without seeing it; but he does not deny that it was a signal that might have been a stop signal. And, even if he were to claim that the Dixmont signal was not liable to indicate to him anything more dangerous than caution, he would have to admit that after passing it without seeing it he was bound to be prepared to stop at the next signal. With his mind on his duty, he could not run a half mile beyond a signal without realizing that he had done so. (On "thin" roads, with few landmarks, a claim that bearings were thus lost is often made; but in many cases it is only a "claim"; and on a busy road like this such a claim "don't go.")

A reporter conjectured that this runner was reading the signals for the other eastbound track. The engineman makes no such excuse; but it is pertinent to observe that runners on four-track lines do now and then make that mistake when running at night. No one who has ridden much on engines at night will be greatly surprised at this. The only precaution that can be taken, in addition to the obvious one of enjoining enginemen to keep their wits always sharpened, is to elaborate and emphasize the rule requiring enginemen and firemen to speak to each other on sighting signals. This rule usually is not well enforced—or if any superintendent does enforce it he carefully conceals the fact—and it is not clear how it can be thoroughly enforced without the use of some kind of mechanical or electrical check; but if it is ever useful anywhere it ought to be particularly so—and ought to be appreciated by thoughtful and conscientious enginemen—where a train is running temporarily on a track which it is not accustomed to run on. The habits of the engineman constitute one of the elements of the safety of his train; he often does things right because he has habituated himself to do them in a certain way. But here is a condition in which habit may easily become an element of danger; hence the need of a special modified habit.

The Pittsfield collision probably could have been prevented by (1) a better watch; or (2) by enforcing the rule that train movements must never be made dependent on a single time-piece, or (3) by the use of the block system, with which watches are not essential. The absence of the second means —the sending of an engine over the road without a conductor—is the feature for which, no doubt, the company will be most severely condemned; but the third means—the block system—is the only satisfactory preventive.

The electric car accidents reported in the newspapers in March number 26, in which five persons were killed and 214 injured. Ten or more of these accidents occurred on the subway or elevated lines in New York City in the two weeks following the strike.

The paper by Dr. Warne on the business organization of the United Mine Workers, part of which is reprinted this week, describes fully and clearly the executive management of the greatest union in the country, and incidentally enters an unconscious plea for trades unionism on the basis of results achieved in the interest of the working man. The reader may dissent from many of Dr. Warne's conclusions, but he will surely agree with the last of them, that the most important work of the intelligent labor leader is to direct his organization along the lines indicated by a study of the labor market and of the general market. The recent Interborough strike affords a concrete instance where this was not done. The vivid description of the work of the walking delegate puts that much-hated person in a rather new light, and the merit of the paper as a whole is that it is fair; the writer clearly favors the position of the union as against the advocates of the open shop, but he can see the defects in his own cause. His comparison of corporation methods with union methods is quite striking.

Press despatches say that the railroads in Oklahoma, after ineffectual protest before the Governor, have decided to comply with the Noffsinger demurrage law, recently passed. Under this law, shippers making written or *verbal* application for cars must have their wants supplied within four days; failure subjects the road to a penalty of one dollar per day per car, in addition to actual damages sustained by the shipper. Freight must be moved at the rate of 60 miles a day on pain of a similar penalty, and the penalty is made to apply to freight in less than carloads. There are the usual rules about demurrage at destination; but on cars holding 30 tons or more, the free time is 72 hours, though the rate to be paid after the expiration of the free time is the same for all sizes. There is a clause which attempts to provide a remedy for shippers and consignees, when cars are "bunched" or not delivered with reasonable regularity. The law also provides a rate for storage in freight houses. The railroads will endeavor to frame rules by which shippers shall be deterred from making needless demands for cars.

It is announced that the German government is to send delegates to the International Railway Congress, and the officers of the Congress have arranged to allow in the discussions the use of the German language on the same footing as English and French. By this action Germany terminates a policy of aloofness that has been maintained for 20 years, only 162 miles of German roads have been represented hitherto in the Congress. By the accession of Germany the Congress becomes really representative of the whole world, all other countries of importance having joined before the American roads.

Pennsylvania Lines West of Pittsburg.

The two main divisions of the Pennsylvania Lines West of Pittsburg are the Northwest System, operated by the Pennsylvania Company, and including the Pittsburg, Fort Wayne & Chicago, running from Pittsburg to Cleveland, Toledo and other points on Lake Erie, and via Fort Wayne to Chicago, with two north and south lines to Columbus, and the Southwest System, operated by the

Pittsburg, Cincinnati, Chicago & St. Louis, and running from Pittsburg to Columbus, Cincinnati, Indianapolis, Louisville and over the Vandalia to Terre Haute and St. Louis, with a more round-about line from Pittsburg to Chicago. The Pennsylvania Co., all of whose $40,000,000 capital stock is owned by the Pennsylvania Railroad Co., controls directly or indirectly the entire mileage west of Pittsburg, amounting on Dec. 31, 1904, to 5,043 miles. In addition to the lines included in the Northwest and Southwest Systems, the Grand Rapids & Indiana with 566 miles of line running from a Cincinnati connection at Richmond, Ind., north to Grand Rapids and Mackinaw City, Mich., and other companies with 1,471 miles of line, are operated under their own organizations.

All lines west of Pittsburg and Erie owned, operated, controlled by or affiliated in interest with the Pennsylvania Co., show total gross earnings of $81,401,961 in 1904, against $81,691,662 in 1903. Expenses were $60,344,578 in 1904, against $62,018,247 in 1903, leaving an increase in net earnings of $1,383,967, from $19,673,416 in 1903 to $21,057,383 in 1904. Gross earnings on the lines directly operated by the Pennsylvania Co. were $36,390,582 in 1904, against $36,602,935 in 1903, a decrease of $212,353. Expenses, at the same time, decreased $1,073,322, leaving net earnings of $10,347,220 in 1904, against $9,486,251 in 1903, an increase of $860,969. Gross income was $15,413,218 in 1904, an increase of $1,559,500, and net income $5,187,930, an increase of $68,289. Gross earnings of the Pittsburg, Cincinnati, Chicago & St. Louis show, in general, the same record, a considerable decrease in gross earnings, a very much larger decrease in operating expenses, leaving considerable increases in net earnings, gross income and net income for the year.

It would be much easier to analyze the Lines West as a whole if the income account for all lines showed earnings and expenses in detail. As it is, some interesting comparisons between different parts of the system may be drawn. Earnings from passenger traffic on the 1,340 miles directly operated by the Pennsylvania Co. decreased by $249,207 from the figure in 1903. On the Pittsburg, Cincinnati, Chicago & St. Louis, on the other hand (all lines directly operated, 1,424 miles) passenger earnings increased by $368,315. These results, of course, were due to the Louisiana Purchase Exposition, as western travel was diverted from the Northwest System, via St. Louis instead of via Chicago, and all of the Pennsylvania's traffic to St. Louis from the lines east of Pittsburg went over the Panhandle route. The effect of the Exposition on passenger earnings is strikingly shown in the detailed reports of the Terre Haute & Indianapolis (80 miles), which runs from Indianapolis to the Illinois-Indiana State line, on which earnings from passenger traffic increased $212,762, or 48 per cent. over 1903, and of the St. Louis, Vandalia & Terre Haute (158 miles), which connects all lines east of Indiana with St. Louis. This company shows increases in earnings from passenger traffic of $646,381 over 1903, or 104 per cent.; of 62 per cent. in the number of passengers carried; of 156 per cent. in the passenger mileage, and of 58 per cent. in the average distance each passenger was carried, which was 56 miles in 1903, and 88 miles in 1904.

The expense accounts of all lines show decreases in maintenance of way and maintenance of equipment due largely to the heavy expenditures during 1903 in renewal of equipment, bridges and tracks. The decrease in conducting transportation was due to the lower cost of fuel and to the increased freedom of operation following improvements. The total decrease in expenses on all lines was $1,673,669 from the 1903 figure.

Traffic statistics show that on the lines of the Pennsylvania Co., the average distance each ton of freight was carried was 72 miles; on the Pittsburg, Cincinnati, Chicago & St. Louis, 91 miles, and on lines operated under their own organizations, 67 miles, an average of 77 miles. The number of tons carried per mile of road was as follows: Pennsylvania Co., 41,885 tons; P., C., C. & St. L., 21,735 tons; lines operated independently (Grand Rapids & Indiana, 5,695 tons), 8,000 tons; average, 22,137 tons, an increase of 357 tons over 1903. Freight earnings on all lines decreased $364 per mile of road, freight expenses $545 per mile, and net earnings increased $181 per mile. There was an increase of 3,449,574 tons in the amount of bituminous coal carried on all lines, which is considerably more than the increase of 2,103,419 tons for the total tonnage hauled. On the P., C., C. & St. L., the number of passengers carried decreased by 73,559, or 5 per cent., while passenger mileage increased 38,520,708 miles, or 12 per cent. At the same time the average number of miles each passenger was carried increased by 33 miles, or 4 per cent., and the passenger revenue increased 6 per cent., all of which figures show the effect of long haul travel due to the Exposition.

According to the company's basis of allotment, net earnings from passengers on the Pennsylvania Co.'s lines show a loss of $75 per mile of road, although for all lines there was a profit of $115 per mile, which is an increase of $57 over the figure for 1903. On the P., C., C. & St. L., the net passenger earnings were $125 per mile, and on lines operated independently, $245 per mile. Passenger earnings were 16 per cent. of the total earnings of the Pennsylvania Co.; 24 per cent. on the P., C., C. & St. L., and 30 per cent. on lines operated independently, an average of 22 per cent. The number of passengers carried one mile on all lines was 869,602,102, an increase of 95,167,071 over 1903. Net earnings per mile of road were as follows: Pennsylvania Co., $5,014; P., C., C. & St. L., $3,135; other lines, $845; average, $2,753.

Any company would be fortunate to receive so large an average return from investments as the Pennsylvania Co. does. This income in the year just passed increased $1,159,773 over 1903, and amounted to $7,120,349, or over 6 per cent. on the cost of all securities owned, whether revenue-producing, valuable merely for control, or absolutely unprofitable. The only increase in capitalization was an issue of $10,000,000, Series D, guaranteed trust certificates of the Pennsylvania Co., maturing in 1944, and secured by an equal amount of Pittsburg, Ft. Wayne & Chicago special guaranteed stock deposited as collateral, which were sold to make partial provision for the issue of $50,000,000 temporary collateral obligations, maturing Oct. 1. On Jan. 1, 1905, the Terre Haute & Indianapolis, St. Louis, Vandalia & Terre Haute, Terre Haute & Logansport, Logansport & Toledo, and Indianapolis & Vincennes were consolidated under the name of the Vandalia Railroad Co. This consolidation merges into one system under the control of the Pennsylvania Co. lines connecting Indianapolis with St. Louis, and tributary lines extending to Vincennes on the south, and to South Bend and Butler, Ind., on the north, a total of 631 miles of line.

As already forecasted in the review of the report of the Pennsylvania Railroad Co. (March 3, page 175), the achievement of the management has been during a rather unprosperous year to so reduce expenses that net earnings and net income should not suffer. The ability to do this so successfully is a complete vindication of the policy of heavy expenditures for improvements, employed so generously during the two years just passed.

The principal statistics of operation follow:

	1904.	1903.
Mileage worked	5,043	5,059
Freight earnings	$56,714,188	$58,390,416
Passenger earnings	17,555,781	16,613,182
Gross earnings	81,401,961	81,691,662
*Maintenance of way	3,842,144	4,341,853
*Maintenance of equipment	5,829,573	6,066,670
*Conducting transportation	14,439,818	14,836,711
Operating expenses	60,344,578	62,018,247
Net earnings	21,057,383	19,673,416
Gross income	28,653,488	25,880,939
*Net income	5,187,930	5,119,641

*Pennsylvania Co.: all lines operated directly.

NEW PUBLICATIONS.

Elements of Mechanics—By Mansfield Merriman, Professor of Civil Engineering in Lehigh University. New York: John Wiley & Sons, 1905. 12mo, cloth, 172 pages, $1.00.

This volume presents the fundamental principles of applied mechanics in such order and manner that they can readily be understood by all who have a knowledge of plane geometry, elementary algebra, and plane trigonometry. The subject is divided into seven general headings, viz.: Concurrent Forces, Parallel Forces, Center of Gravity, Resistance and Work, Simple Machines, Gravity and Motion, and Inertia and Rotation. These are subdivided into 40 articles or lessons, which follow each other in logical sequence. The axioms or laws are illustrated so that they are readily understood, and the table of trigonometric functions given at the end of the book contains an extra column which will aid the beginner in its use. Ten problems are given at the end of each article, making 400 problems in all, the answers to most of which are given at the end of the book. These problems illustrate clearly the application of the fundamental laws of mechanics, and the solving of the problems will give the student a knowledge of the subject that can be gained in no other way. A large number of figures, in the text, aid greatly in understanding the subject.

This volume will be of great value to young men who have finished the fundamental subjects mentioned above, particularly if they follow a technical line of work without having had a regular technical training; and it will be of especial value if studied in the first year of a college course as there is scarcely a technical subject that can be given that does not necessitate a knowledge of these principles. And, in addition, a mastery of these fundamental principles of mechanics which are illustrated so often in everyday life, will give a much clearer insight into the advanced part of the subject when treated with the aid of advanced mathematics.

Berlin-Zossen Electric Railway Tests.—Translated from the official report in German by Frank Welz, with an introduction by Louis Bell. New York: 1905. McGraw Publishing Company. Cloth, 100 pages. Price $3.

The Berlin-Zossen tests of 1903 were remarkable not only for the speeds which were reached which were higher than ever before attained, but also for the large amount of valuable and accurate data on train resistance, collection of electric current, track construction, etc., which was secured in the extensive series of test runs made. Much has been written about them, more or less fragmentary and inaccurate, but the official report, which has been compiled with characteristic German thoroughness, presents the results as a whole in their proper order and logical relation to each other and is therefore a most valuable document. This translation of the report is an excellent and intelligent one and has the merit from an

American point of view of having all of the data and diagrams compiled in both English and metric measurements. The introduction by Dr. Bell is a comprehensive monograph on the general subject of train resistance with special reference to speeds as affected by the data obtained from the tests. The most interesting point brought out is the determination of the constants in the general equation for train resistance $A + B V + C V^2$. The constant C, as determined in terms of kilograms per square meter for head and pressures and kilometers per hour for speed, reduces to .0052. The corresponding coefficient in pounds per square feet and miles per hour is .0027. Previous coefficients commonly used are more than twice those found from the Berlin-Zossen tests.

American Telephone Practice. By Kempster B. Miller. New York: McGraw Publishing Company, 114 Liberty street. Cloth, 7 in. x 10 in., 904 pages, 643 illustrations. $4.

This is an entirely rewritten and greatly enlarged edition of Mr. Miller's well-known book, first issued five years ago. Emphasis should be placed on "greatly," and it is in one sense unfavorable emphasis, for a book 7 in. x 10 in., and over 2 in. thick, is too large for convenience, especially when the idea of bigness is constantly thrust upon the reader's attention by the wide margins on the pages. The type-forms in this book are only 4⅛ x 6¾ in., so that by reducing the margins to reasonable proportions and using slightly thinner paper, the volume could have been made much pleasanter to handle. The book contains 42 chapters. The first three deal with elementary principles and history; then there are separate chapters on all parts and kinds of telephones and calling apparatus; on lines, exchanges, power plants and accumulators; on the duties of operators and their qualifications, on line construction, testing, and, in fact, everything connected with the material side of the telephone business.

Of Mr. Miller's ability to handle his subject, the reader will scarcely need assurance. He is thoroughly acquainted with every branch of the telephone art and is a lucid writer. The illustrations are very good, but many of them are unnecessarily large.

TRADE CATALOGUES.

Corrugated Bars for Reinforced Concrete.—The 1905 catalogue of the St. Louis Expanded Metal Fireproofing Co. is an enlargement and revision of the preceding issue. The introduction gives some new and important facts not previously brought out. The company has patented and is now rolling a new type of bar having a constant cross-section, but will also continue to make the old bar. The catalogue fully illustrates and gives essential details regarding all sizes of both types of bars and also illustrates a large and varied line of reinforced concrete structures. There is also considerable information on the design of reinforced concrete members and structures.

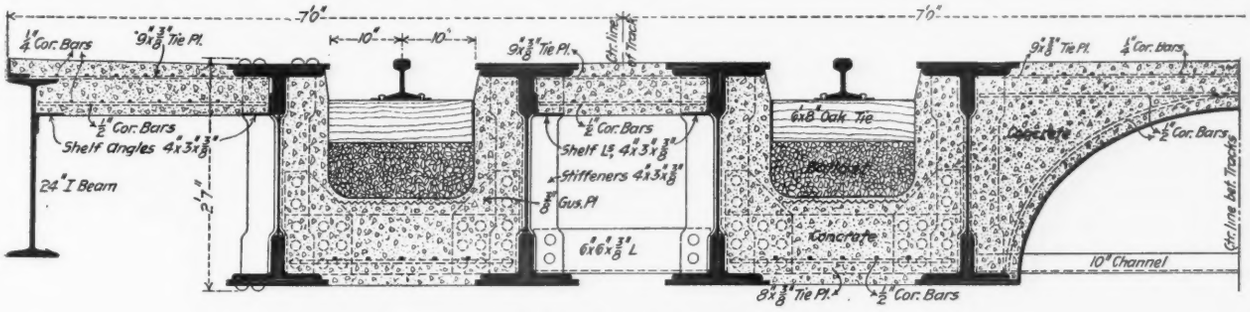
Mechanical Conveyors.—Catalogue No. 053 of the C. W. Hunt Co., West New Brighton, N. Y., describes the Hunt noiseless conveyor and its application to coal handling plants. It is profusely illustrated with views and drawings of a large number of power stations and coal pockets in which this system has been installed.

Second-Hand Machines.—The April list of second-hand machines in the stock of J. A. Fay & Egan Co., Cincinnati, Ohio, shows the usual large variety of wood-working tools; also a considerable list of engine lathes and some miscellaneous iron-working tools.

Air Compressors.—The Sullivan Machinery Company, Chicago, Ill., sends its bulletin No. 53A. It describes in detail the Sullivan straight line air compressor. Illustrations throughout the pamphlet show sectional views and details of the various parts of the compressor.

A Shallow Solid-Floor Girder.

A cross-section of a 32-ft. girder, designed to combine all of the advantages of a deck girder with the shallow floor of a through girder, and with none of the disadvantages of the latter, is shown herewith. An additional advantage is the solid concrete floor, with rock or cinder ballast, giving a noiseless, practically fireproof floor and a continuous roadbed—important requisites in bridges of this sort, especially where used for overhead crossings in cities.



A Shallow Solid Floor Girder.

In the design shown, the distance from top of rail to lowest point of steelwork is 2 ft. 7 in., about the same as in the shallowest floor of a through girder of ordinary construction. The sections of the flanges are not abnormal. As a matter of fact, the weight of the structural steel in a 32-ft. single-track span of this type would be a trifle less than that in an ordinary through-girder span of the same length. This girder was designed to carry a 184-ton engine with 50 per cent. impact added. The steel in a single-track span, with a sidewalk on each side, would weigh about 40,000 lbs.

Rapidity of erection is another advantage claimed. The two girders carrying one rail may be shop-riveted together as shown, and shipped to the bridge site. The reinforced concrete floor is then built in and ties and ballast placed in position if so desired. The completed halves of the bridge are then lifted bodily and placed in position. The small amount of field riveting necessary to tie them together is then done, the rails laid and the bridge is ready for traffic, the riveting and concreting for the sidewalks, between girders and between tracks, being done at leisure. Where this type of bridge spans the tracks of another railroad the steelwork may be protected from smoke and gases by covering the lower flanges of the girders with expanded metal and concrete and filling between the girders with reinforced concrete as the space between tracks is filled, or by any of the several approved methods for such protection.

The rails are spiked to the ties, as in ordinary construction, and as the concrete troughs are carefully built to exact dimensions and the ties cut to exact length—about ¼ in. less than the width of the trough—the gage of the rails will be maintained. The flanges of the girders also act as guard rails in case of derailment.

Where the bridge is on a grade, the drainage will, of course, be toward the lower end, where it is easily taken care of. Where the bridge is level, the concrete under the rails is made thicker transversely at the middle of the bridge to cause drainage toward both ends. In very short spans, however, the extra thickness is placed at one end, throwing all the drainage in one direction. First class free-draining ballast must, of course, be used in all cases. This type of structure can be made more cheaply still if a greater depth can be allowed and even for spans of considerable length the designer believes that, all things considered, it will prove to be an economical type of construction, provided that too much shallowness is not insisted upon.

The girder was designed by Mr. A. R. Eldridge, Chief Draftsman of the bridge department of the Chicago, Burlington & Quincy, of which Mr. C. H. Cartlidge is Bridge Engineer.

The Consular Service.

Robert J. Gross, Second Vice-President of the American Locomotive Company, recently delivered an address on the American consular service before the National Business League of Chicago, and that organization has reproduced it in pamphlet form. Mr. Gross spoke from observations which he made on a trip around the world, interviewing the government representatives wherever he went; and he believes that, although the personnel of the American consular service, especially in the larger foreign commercial centers, includes many officials of unquestioned ability and efficiency, the service, as a whole, is far below the standard of usefulness it should have. The consular service has a chance to be of great value in the advancement of foreign trade, and certain other countries, such as Germany, have developed this service greatly. The new German commercial attachés are required to speak well the language of the country to which they are sent, provided it be English, French, Italian, Spanish or Russian. They must have a thorough knowledge of the weights, measures and currency locally used, and, if they show energy and efficiency and

accomplish results, they will be kept at their posts indefinitely. In fact, the chief merit claimed for the present consular service of Germany is its permanence; the length of time during which competent officers are left at the same post to utilize the knowledge that only prolonged residence among an alien people can give. Mr. Gross complains that many of our consuls are foreigners who speak English with difficulty and have no knowledge of our national traditions. The consular salaries are so low that it is usually a disgrace to the government for an attache to be seen at his lodgings, and the entire service is directly in the field of political spoils. It certainly seems that the broadening of the foreign market for American industries should justify the organization and maintenance of a consular service on a basis of fitness and efficiency, while the corollary is undoubtedly true that if the government wants good men in the consular service, it must be prepared to pay for them.

Further Tests of Reinforced Concrete Beams.*

BY W. KENDRICK HATT,
Professor of Applied Mechanics, Purdue University.

This article records the results of tests made in the laboratory of Purdue University on 47 reinforced concrete beams, discusses the relative flexibility of plain and reinforced concrete beams, as shown by the data of these and other recorded tests, and quotes empirical formulæ for the strength of the beams. Fourteen of these beams were reported to the American Society of Testing Materials and published in the Transactions, Vol. II, 1902. The remainder of these beams were tested since that time.

Nature of the Beams.—The beams were generally made of 1-2-4 concrete, a few of them being 1-5 gravel concrete. The cement used was Peninsular and Giant brands of American Portland cement and was supplied for the purpose by the manufacturers. The sand was excellent pit sand (33 per cent. voids) and the stone was Kankakee limestone (43.7 per cent. voids); the entire product of the crusher below 1 in. being used. There was considerable crusher dust in the stone. The gravel was excellent pit gravel, containing sand and pebbles (20 per cent. voids). The beams were made of somewhat dry concrete and well rammed until the mass was plastic and water flushed to the surface. The metal reinforcement was partly steel and partly wrought iron with elastic limits of 33,000 lbs. and 36,000 lbs. per sq. in., respectively. The steel was supplied by the Carnegie Steel Co.

The concrete showed the following strength:

Composition and Strength of Concrete in Test Beams.

Composition				Age, days.	Modulus.		Ult. strength.	
Cement.	Sand.	Stone.	Gravel.		Compression.	Tension.	Comp.	Tension.
1	2*	5	..	90	4,610,000	5,460,000	2,513	359
1	2*	5	..	28	3,350,000	3,800,000	2,067	237
1	..	..	5†	90	4,800,000	4,510,000	2,804	290
1	..	..	5†	28	3,790,000	4,320,000	2,239	253

*Part 1 : 1.6 : 5 concrete.
†Part 1 : 6 concrete.

Tests.—The beams were supported at the ends and tested with a center load with a span of 80 in. The loads and accompanying deflections were noted and the loads were released at intervals to obtain the set. The normal character of the curve thus obtained is shown in Fig. 1. In 1902, when these tests were begun, the writer attempted without success, to obtain satisfactory measurements to locate the neutral axis of the beams, and at the time was not able to explain the reasons for the characteristic features of this curve. In discussing these tests, Mr. Edwin Thacher suggested that the tensile resistance of the concrete became zero at the point A. The significance of the various characteristic points of this curve has recently been shown by Prof. A. N. Talbot in an article in the *Bulletin University of Illinois*, Vol. II., No. 1, and also by Prof. F. E. Turneaure in a paper published in the *Transactions* of the American Society for Testing Materials, Vol. IV., 1904. Both of these writers measured the deformations at the top and the extensions at the bottom of a series of reinforced concrete beams. In describing the characteristics of this curve, the writer will take advantage of the information supplied in the papers mentioned.

It will be noted that the stages of flexure are four:

(1.) Up to the point A the deflections are fairly in proportion to the load. Beyond this point A, the deflections increase more rapidly than the load. Prof. Turneaure has shown that at about the point A very fine microscopic cracks, as shown by water marks on a wet beam, begin to form themselves. Prof. Talbot has shown that at this point the steel suddenly takes on an increased stress. The extension of the steel at the point A is about 12 parts in 100,000, as shown by Prof. Talbot's and Prof. Turneaure's tests, corresponding to a stress of 3,600 lbs. per sq. in., on a basis of 30,000,000 lbs. per sq. in. for the modulus of elasticity of the steel. Up to the point A the concrete carries stress in tension.

(2.) Beyond the point A is what Prof. Talbot calls "the readjustment stage," in which the load is thrown from the concrete in tension to the steel, due to the action of these small cracks, which are, it may be noted, not visible to the naked eye.

(3.) After the readjustment stage the increments in the deformation of the steel are closely proportioned to the increments of the load applied. After a load which according to the writer's tests is about three and one-third times the load at point A, and after a deflection which is nearly six times that at point A, a crack—called "the first crack"—is visible to the naked eye of the observers specially stationed to watch for such cracks. Other cracks were later formed at other sections.

Table I shows the relation between the point A and the first visible crack:

Table I.—Relation, First Visible Crack to Point A.

		Ratio—Load at 1st crack to load at point A.			Ratio—Deflection at 1st crack to deflection at point A		
Reference	No.	Av.	Max.	Min.	Av.	Max.	Min.
Talbot	19	2.17	4.08	120	4.84	9.29	1.38
Turneaure..	8	1.65	2.14	1.06	2.59	4.46	1.17
Hatt 1-18		3.36	6.11	1.87	6.04	8.90	2.90

Concerning the stress in the steel at the point of first crack, it may be said that in Prof. Turneaure's tests (on 1-2-4 concrete) this crack appeared at an extension in the concrete of about three times that at the point A, and in Prof. Talbot's tests (on 1-3-6 concrete) at an extension of about 5.7 times that at point A, indicating in the former case a stress in the steel of 12,000 to 16,000 lbs. per sq. in., and in the latter case a stress in the steel of 23,000 lbs. per sq. in. These fine cracks, it may be noted, close up when the load is removed, and cannot enlarge to a serious extent until the steel reaches its elastic limit. Comparing the deflection of plain beams at rupture with the deflection at first visible crack of reinforced beams, we have the ratios given in Table II.

Table II.—Ratio of Deflection of Plain and Reinforced Beams.

Reference.	Average.	Maximum.	Minimum.
Talbot	9.5	23.4	3.3
Turneaure	5.4	8.2	3.2

(4.) At a load which is about four times the load at point A, and at a deflection which is about nine times the deflection at point A, as based on the writer's tests, the beams refuse to carry any additional load. The steel has passed its yield point and the cracks are wide open and will not close upon the removal of the load. The values of four and nine above mentioned become 4.3 and 16 in Prof. Talbot's tests; and 3.5 and 9 in Prof. Turneaure's tests. It appears from the tests of the former that when soft steel of about 33,000 lbs. elastic limit is used, up to the extent of 1½ per cent., the reaction of the steel is not sufficient to develop the crushing strength of the concrete. In the writer's tests of beams under a center load, 2½ per cent. of steel failed to develop the crushing strength of the concrete. It is evident that the range between the point A and the first crack will depend very largely on the quality of the concrete, and on its age. The poorer the concrete, and the older

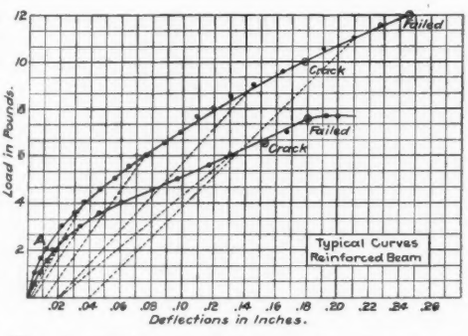


Fig. 1—Typical Load-Deformation Curves for Reinforced Concrete Beams.

and dryer the concrete the nearer the first crack will be to the point A.

Results of Tests.—The results of the tests of these 47 beams are shown in Table 3, in which are quoted the average ratio of load and deflection at first crack and ultimate strength. A comparison of the steel is quoted, both on the actual cross section, and also on the area of the cross section above the steel, the latter being the common basis.

Relative Flexibility of Plain and Reinforced Concrete Beams.—A sufficient number of plain concrete beams was not tested to supply an extended basis of comparison. The writer's tests combined with those of Profs. Talbot and Turneaure show that the plain beams crack and break at a point corresponding to the point A. In other words, fine cracks appear at the same stage of flexure in both plain and reinforced concrete beams. Some writers have held this to be a refutation of Considere's thesis that reinforced concrete may extend at least ten times as far as plain concrete without cracking. It is, however, a question of the significance of the term "crack." As far as this relates to the danger to, or unsightliness in a large structure, due to the presence of the crack, we may disregard these microscopic cracks, which certainly exist in the concrete, and we may fix on the first crack visible to the naked eye as the ultimate practical flexibility of a beam. Since in beams Nos. 1 to 18 this visible crack occurs on an average at a deflection six times that of the point A, the value ranging from 8.9 to 2.9

*From a forthcoming volume of the *Engineering Review*, published by the Engineering Societies of Purdue University.

(see table for other comparisons), Considere's statement is practically true. He himself discusses the existence of these fine cracks. The relation of the flexibility of plain beams at rupture to reinforced beams at rupture (Table II.) also throws additional light on the practical significance of Considere's thesis.

The lesson to draw from these facts is, in the writer's opinion, not that the steel in reinforced concrete beams must be stressed below the point A, but that the computation of the moment of resistance of the concrete beam beyond the point A must not include the tensile resistance of the concrete. The only function of the concrete below the steel beyond the point A is to protect the steel from rust.

This discussion has a bearing on the safe unit stress to allow on steel reinforcement by designers. Accepting Prof. Talbot's and Prof. Turneaure's measurements, it appears that on the average the point A corresponds to the stress in the steel of from about 3,000 to 5,000 lbs. per sq. in., and that the first visible crack will not appear until a stress has been reached of from 12,000 in Prof. Turneaure's tests to 23,000 lbs. per sq in. in Prof. Talbot's tests. The writer estimates the stress to be 27,000 lbs. at the first crack in the beams tested by him. The greater flexibility may be due to a richer mixture, as there was a considerable per cent. of crusher dust in the concrete. The dust is known to improve concrete. A proposition to confine the stress in the steel to less than 3,000 lbs. per sq. in. is unjustifiable, and it would seem the part of conservative designing to use unit stresses at least as high as 12,000 lbs. per sq. in. Further experimental study is needed to determine if this unit value can be increased when the concrete is specially prepared for the purpose. It may be urged that many structures, in which the steel has been designed to carry 16,000 lbs. per sq. in., are giving good service and not showing cracks.

(1.) Comparing the strength of 1-2-4 broken stone concrete with 1-5 gravel concrete, the high value of the latter material is clearly shown, as follows:

Comparative Strength of 1:2:4 stone and 1:5 Gravel.

	Average load at First crack.	Ult.	Reference No.
	A.		
Stone.	2,900	7,188	8,462 3, 4, 5, 6, 7, 8, 14, 15
Gravel.	2,362	7,981	8,019 39 to 46, inclusive.

(2.) Comparing the strength of single and double reinforcement, it seems that the steel in the compression flange does not add to the strength of the beam and is not economically placed.

Comparative Strength of Single and Double Reinforced Beams.

	Average load at First crack.	Ult.	Reference No.
	A.		
Single	4,000	9,940	11,825 7, 8, 16 and 17.
Double.	3,187	6,125	11,125 27, 28, 31, and 32.

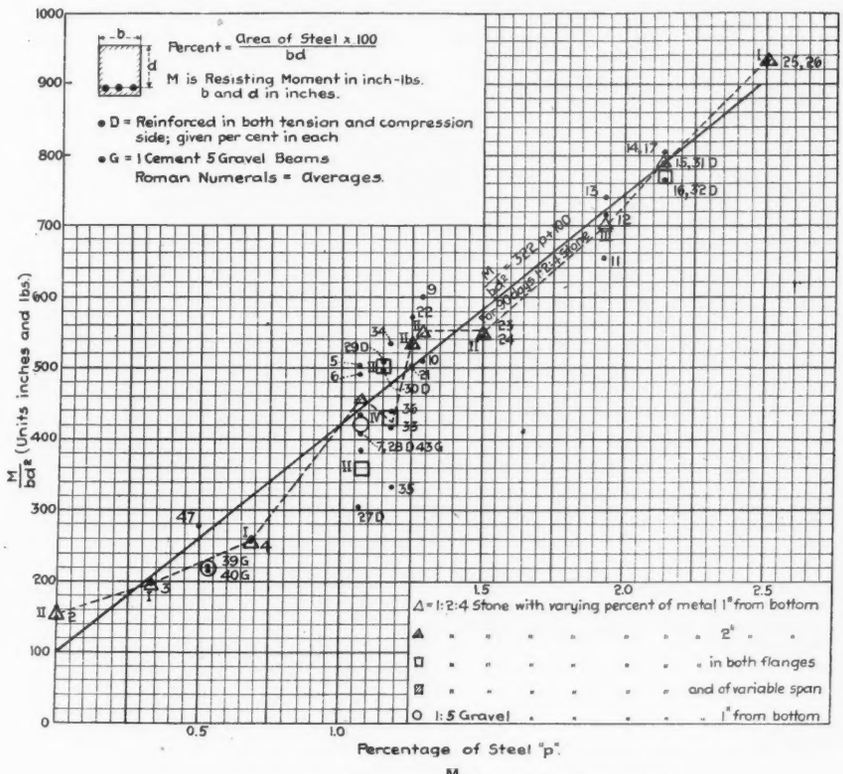

Percent = Area of Steel x 100 / bd
M is Resisting Moment in inch-lbs. b and d in inches.
• D = Reinforced in both tension and compression side; given per cent in each
• G = 1 Cement 5 Gravel Beams
Roman Numerals = Averages.
M/bd² (Units inches and lbs.)
Percentage of Steel "p".
Δ = 1:2:4 Stone with varying percent of metal 1" from bottom
2" " " "
in both flanges
and of variable span
1:5 Gravel
1" from bottom

Fig. 2—Variation of $\frac{M}{b\,d^2}$ at Ultimate Strength.

Adjustment of Table III. for Formula.—The internal relations in Table III. enable the results to be reduced to a common basis, in which the relation of the two factors of per cent. of steel, computed with reference to the area of the beam above the steel, and the value of the resisting moment may be determined. For this purpose the ratio of the strength at 28 days and the strength at 90 days is determined, and the 28-day beams, Nos. 5, 6, 14, 15, 21, 22, 25, 26, 29 and 30 are multiplied by the factor of 1.317 for ultimate and .966 for first crack to render the comparison on the same basis of age, namely, 90 days. In the same way beams Nos. 33, 34, 35 and 36 of shorter span, are modified to a basis of 80-in. span. The maximum load on beam 18, 3 per cent. reinforcement, is omitted, because this beam failed by horizontal shear. The remaining beams failed by cracking at the center at a point near the yield point of the metal reinforcement.

In this way Figs. 2 and 3 are prepared, showing the respective values of the resisting moment at the ultimate load and at the first crack respectively as affected by the amount of metal embedded in the beams. The straight line is drawn to fit the results of the tests on 1-2-4 stone concrete at 90 days. The tests on gravel concrete beams, and on the stone beams of double reinforcement, were not used in obtaining this line, although they are shown on the diagram.

These diagrams are plotted for the net loads. Adding to these the half weight of the beams (about 250 lbs.), the value of $\frac{M}{b\,d^2}$ must be increased by 25.5 units. The straight line formulas resulting are as follows:

For 1-2-4 stone concrete 90 days old.

Ultimate Loads.

$$\frac{M}{b\,d^2} = 125 + 348p \quad \ldots\ldots\ldots (1)$$

First Crack.

$$\frac{M}{b\,d^2} = 125 + 195p \quad \ldots\ldots\ldots (2)$$

For 1-2-4 stone concrete 28 days old.

Ultimate Strength.

$$\frac{M}{b\,d^2} = 102 + 270p \quad \ldots\ldots\ldots (3)$$

First Crack.

$$\frac{M}{b\,d^2} = 102 + 154p \quad \ldots\ldots\ldots (4)$$

Mr. T. L. Condron in the *Journal* of the

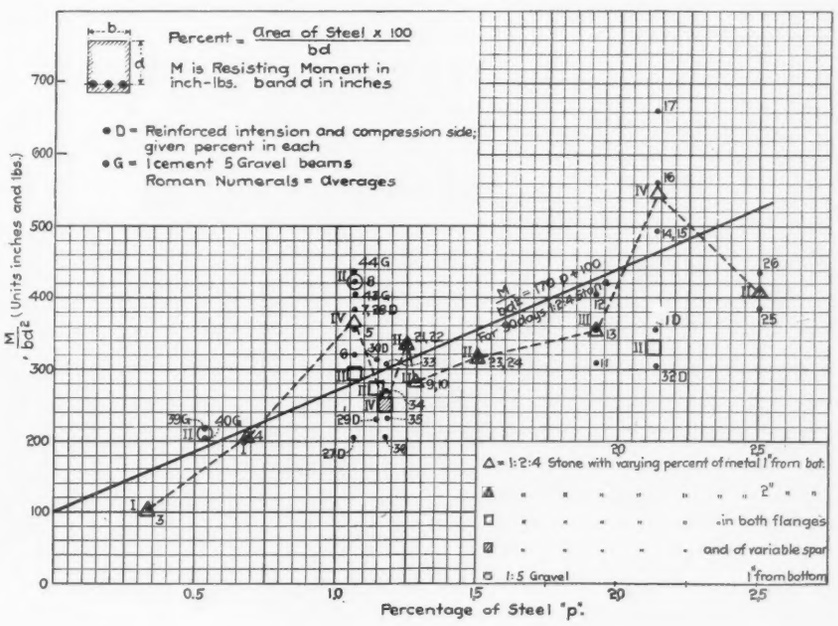

Percent = Area of Steel x 100 / bd
M is Resisting Moment in inch-lbs. b and d in inches
• D = Reinforced intension and compression side; given percent in each
• G = 1 cement 5 Gravel beams
Roman Numerals = Averages
M/bd² (Units inches and lbs.)
Percentage of Steel "p".
Δ = 1:2:4 Stone with varying percent of metal 1" from bot.
2" " " "
in both flanges
and of variable span
1:5 Gravel
1" from bottom

Fig. 3—Variation of $\frac{M}{b\,d^2}$ at First Crack.

Western Society of Engineers for March, 1905, derived a formula similar to No. 3 from part of the above data combined with tests made in other laboratories of 1-3-6 concrete and 1-2-4 concrete of various ages, thus $\frac{M}{b\,d^2} = 55 + 275p$.

The last term on the right-hand side of these equations is evidently the amount of resisting moment supplied by the stresses in the steel. Thus, in the third formula, this term is 270 pbd^2. The constant 270 includes the following factors: (1) Stress in steel; (2) leverage of the force in the steel about the centroid of the compressive stresses on the cross section. The leverage depends on the location of the neutral axis, and, therefore, on the quality of the concrete (on the proportions and age of the concrete) and on the percentage of the steel. It must be recognized, therefore, that the same constant

Table 3.—Reinforced Concrete Beams.

8x8 Inches in Cross-Section and 80 Inches Span. Plain Bars, Loaded at Center. (For gross loads, add 250 lbs.)

Note.—Per cents on basis of cross-section above reinforcement are given in the line above corresponding test number.

	Beam.				Net load.					Deflections.				
	Kind.	Per cent. metal.	Distance from bottom.	Age days.	Point "A."	First crack.	Ratio to A.	Ult.	Ratio to A.	Point "A."	First crack.	Ratio to A.	Ult.	Ratio to A.
					1:2:4 *Stone with varying per cent. of metal 1 inch from bottom.*									
No. 1.	1:2:4	0.0	..	28	1,200	.....	.....	2,400	2.00	0.001	.....	.....	0.003	3.00
" 2.	"	0.0	..	28	1,200	.....	.....	2,200	1.86	.004	.....	.....	.014	3.50
		0.343												
" 3.	"	0.5	1	112	.....	2,000	.....	3,800	....	.....	.....	.....	.....	.....
		0.691												
" 4.	"	0.6	1	116	1,800	4,000	2.22	5,000	2.78	.020	0.133	6.66	.185	9.25
		1.07												
" 5.	"	1.0	1	25	2,500	7,250	2.90	7,500	3.00	.016	.138	8.65	.145	9.05
		1.07												
" 6.	"	1.0	1	23	2,500	6,500	2.60	7,300	2.92	.025	.150	6.00	.177	7.08
		1.07												
" 7.	"	1.0	1	80	4,000	7,500	1.87	8,000	2.00	.031	.165	3.39	.122	3.94
		1.07												
" 8.	"	1.0	1	80	3,500	8,250	2.36	8,500	2.42	.029	.145	5.00	.145	5.00
		1.28												
" 9.	"	1.2	1	109	1,750	5,500	3.14	11,750	6.70	.016	.093	5.80	.128	8.00
		1.28												
" 10.	"	1.2	1	124	1,800	5,500	3.05	10,000	5.55	.024	.115	4.79	.240	10.00
		1.93												
" 11.	"	1.8	1	90	.....	6,078	....	12,800	....	.....	.....	.....	.....	.....
		1.93												
" 12.	"	1.8	1	109	2,500	8,000	3.19	14,000	5.60	.028	.133	4.75	.275	9.85
		1.93												
" 13.	"	1.8	1	111	2,750	7,000	2.59	14,500	5.27	.042	.122	2.90	.288	6.67
		2.14												
" 14.	"	2.0	1	27	3,000	10,000	3.33	12,000	4.00	.022	.174	7.91	.247	11.20
		2.14												
" 15.	"	2.0	1	25	3,000	10,000	3.33	11,800	3.93	.026	.158	6.07	.208	8.00
		2.14												
" 16.	"	2.0	1	80	1,800	11,000	6.11	15,000	8.34	.020	.178	8.90	.279	13.94
		2.14												
" 17.	"	2.0	1	80	2,300	13,000	4.64	15,800	5.64	.026	.162	6.23	.214	8.23
		3.32												
" 18.	"	3.1	1	108	2,300	13,000	5.65	16,000	6.95	.020	.150	7.50	.181	9.05
	Average				.....	.....	3.36	.....	4.31	.....	.....	6.04	.....	7.86
					1:2:4 *Stone with varying per cent. of metal 2 inches from bottom.*									
		1.25												
No. 19.	1:2:4	1.0	2	7	.....	4,250	....	6,000	....	.....	.160	.....	.248	.....
		1.25												
" 20.	"	1.0	2	9	2,000	3,500	1.75	5,500	2.75	.026	.101	3.89	.280	10.77
		1.25												
" 21.	"	1.0	2	25	2,500	5,000	2.00	5,500	2.20	.026	.140	5.39	.163	6.28
		1.25												
" 22.	"	1.0	2	28	2,000	5,000	2.50	6,250	3.12	.020	.136	6.80	.186	9.30
		1.50												
" 23.	"	1.2	2	109	2,200	4,500	2.04	8,000	3.67	.028	.087	3.11	.200	7.15
		1.50												
" 24.	"	1.2	2	106	2,000	4,500	2.25	7,900	3.95	.016	.084	5.25	.206	12.88
		2.50												
" 25.	"	2.0	2	25	2,000	5,750	2.87	10,250	5.12	.020	.109	5.45	.278	13.90
		2.5												
" 26.	"	2.0	2	27	2,500	6,500	2.60	10,250	4.11	.030	.133	4.43	.278	9.25
	Average				.....	.....	2.29	.....	3.56	.....	.....	4.90	.....	9.93
					1:2:4 *Stone with varying per cent. of metal in both flanges.*									
		1.07												
No. 27.	1:2:4	1.0	1	80	2,250	4,000	1.78	6,000	2.65	.024	.035	1.46	.139	5.79
		1.07												
" 28.	"	1.0	1	80	3,000	7,500	2.50	8,000	2.66	.027	.115	4.25	.133	4.93
		1.15												
" 29.	"	1.0	1.5	30	2,000	4,000	2.00	6,500	3.25	.020	.087	4.35	.176	8.80
		1.15												
" 30.	"	1.0	1.5	30	2,000	5,500	2.75	6,400	3.20	.017	.138	8.13	.170	10.00
		2.14												
" 31.	"	2.0	1	80	4,000	7,000	1.75	13,000	3.25	.048	.098	2.04	.214	4.46
		2.14												
" 32.	"	2.0	1	80	3,500	6,000	1.73	15,000	4.29	.036	.076	2.11	.270	7.50
	Average				.....	.....	2.08	.....	3.22	.....	.....	3.72	.....	6.91
					1:2:4 *Stone with* 1.1 *per cent. metal, and of variable span.*									
	Span, in.	1.18												
No. 33.	60	1.1	1	90	1,600	8,000	5.00	10,900	6.82	.013	.100	7.41	.156	11.56
		1.18												
" 34.	60	1.1	1	90	1,600	7,000	4.37	14,000	8.76	.014	.077	5.50	.204	14.57
		1.18												
" 35.	40	1.1	1	90	3,000	9,000	3.00	13,000	4.33	.009	.040	4.17	.082	8.55
		1.18												
" 36.	40	1.1	1	90	3,750	8,000	2.13	17,150	4.58	.008	.030	3.75	.098	12.25
		1.18												
" 37.	20	1.1	1	90	4,000	14,000	3.50	18,250	4.57	.005	.019	3.72	.042	8.24
		1.18												
" 38.	20	1.1	1	90	5,000	14,000	2.80	24,000	4.80	.001	.008	5.00	.013	8.13
	Average				.....	.....	3.47	.....	5.64	.....	.....	4.92	.....	10.55
					1:5 *Gravel with varying per cent. of metal 1 inch from bottom.*									
	Kind.	0.536												
No. 39.	1:5	0.5	1	90	2,400	4,250	1.77	4,250	1.77	.020	.126	6.30	.126	6.30
		0.536												
" 40.	"	0.5	1	90	2,000	4,009	2.00	4,300	2.00	.015	.110	7.3	.126	8.40
		1.07												
" 41.	"	1.0	1	28	3,000	7,500	2.50	8,000	2.66	.025	.160	6.4	.176	7.04
		1.07												
" 42.	"	1.0	1	28	2,000	7,000	3.50	7,000	3.50	.019	.190	10.0	.190	10.00
		1.07												
" 43.	"	1.0	1	90	2,500	7,500	3.00	8,000	3.20	.015	.142	9.46	.142	9.46
		1.07												
" 44.	"	1.0	1	90	2,500	8,500	3.41	8,500	3.41	.014	.166	11.85	.166	11.85
		2.14												
" 45.	"	2.0	1	28	2,000	11,500	5.75	11,500	5.75	.020	.254	12.70	.254	12.70
		2.14												
" 46.	"	2.0	1	28	2,000	13,100	6.55	13,100	6.55	.014	.248	17.70	.248	17.70
	Average				.....	.....	3.56	.....	3.60	.....	.....	10.21	.....	10.43
	Average of all				.....	.....	2.95	.....	4.06	.....	.....	5.96	.....	9.14
	Maximum				.....	.....	6.55	.....	8.76	.....	.....	17.70	.....	20.60
	Minimum				.....	.....	1.73	.....	1.77	.....	.....	1.46	.....	.....
No. 47.	1:2:4	0.47	1	1 year.	9,000	11,500	1.26	25,000	2.80	.005	.015	3.0	.29	60.2

will not, strictly speaking, apply to different kinds of concrete or percentages. However, the formulas are fairly approximate for preliminary computation.

The most satisfactory method in final computations is that given by Prof. Talbot in a paper appearing in the *Journal* of the Western Society of Engineers, August, 1904. When the quality of the concrete and the per cent. of reinforcement are known, the location of the neutral axis is computed, i.e., the distance from the compression face of the beam to the point where the compression stresses becomes zero. Assuming the law of variations of these compressive stresses, and, therefore, the location of the centroid of the stress area, the leverage arm from the steel to the centroid is thus known. The resulting moment is then

M = Area of steel x stress in steel x leverage to centroid of compressive stresses.

The maximum compressive stress in the steel is then computed. It should be recognized that these computations must take account of the quality of the concrete and that this leverage is different for the various kinds of concrete.

It will be noted that the lines expressing these equations on the diagram do not run through zero of ordinates. They were drawn to fit the tests of reinforced beams and were allowed to intersect the axis of ordinates independently of the points indicating the tests of plain beams.

The formulas indicate that part of the total resisting moment, i.e., the first term, is supplied from another source than the stresses in the steel. Now when in Formula No. 3, p is put equal to 1 per cent. $\frac{M}{b\ h^2} = 102 + 270$. The first term is nearly 38 per cent. of the second. It may be that these straight lines should be replaced by flat curves running through the origin. The strength of a plain beam would be represented by a horizontal line intersecting the curve. In this case the first term in the formula would disappear.

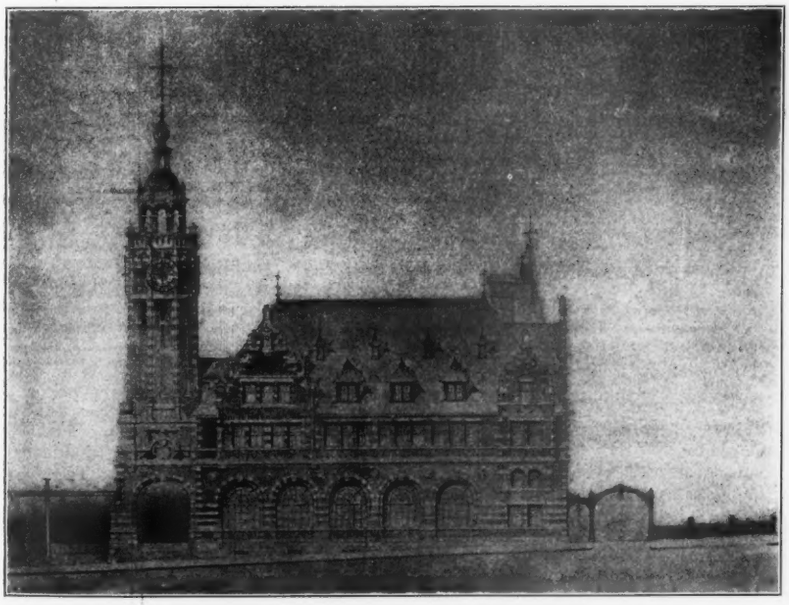
New Pennsylvania Station at Allegheny.

Plans have been prepared by the Pennsylvania Lines, Northwest System, for a new passenger station at Allegheny, Pa., and provided that the city agrees to vacate certain property required the work will be begun this spring. The station will be built on the site of the present station facing on Federal street and extending to the corner of Stockton avenue. It will cost about $250,000, and will complete the railroad company's improvements in Allegheny, chiefly changes of grade begun three years ago.

The building will be three stories high, with a tall tower, and will be in the Flemish style of architecture with stone trimmings. The barber shop, shoe-shining room, smoking room and men's toilet will be in the basement at one end of the building. On the first floor, which is slightly above the level of the street, will be the general waiting room, railroad and Pullman ticket offices, telegraph offices and telephone booths and women's toilet. The baggage room will be under the elevated tracks at one end of the building. This is of frame construction and is already built and in use in connection with the present station.

The second floor will be occupied by offices for the station master, trainmen and ticket receiver, and the third floor will be taken up by division offices of the West Penn Division of the Pennsylvania Railroad. The Adams Express Company will have its own building, fronting on Stockton avenue and extending along the west side of Federal street.

W. L. Price, of Philadelphia, is the architect for the new building.



Side Elevation of Allegheny Station.

East Elevation of New Pennsylvania Station at Allegheny, Pa.

Canadian Railroads in 1904.

The Canadian Government has issued a volume of railroad statistics for the year ending June 30, 1904, entirely apart from the regular Government report. According to this volume, the completed mileage amounted to 19,611 miles, against 19,077 miles in 1903; double-track mileage was 763 miles in 1904, as against 695 miles in 1903, and there were 3,327 miles of sidings. The iron rail is rapidly disappearing from the Dominion, and there was only 66 miles left last June. The capital paid on account of railroads up to date has been $1,186,546,918. This includes Dominion and Provincial bonuses aggregating $195,805,982, and also aid from municipalities to the extent of $17,157,810. Besides the bonuses, the Dominion and Provincial governments have loaned the railroads $20,613,214.

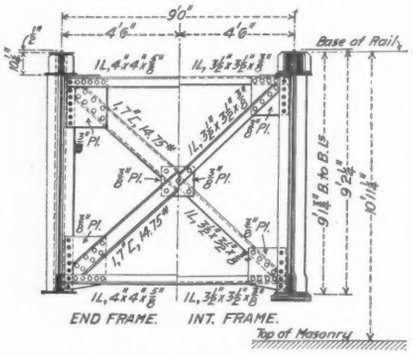
The gross earnings of the Canadian roads amounted to $100,219,436, as against $96,064,526 last year; working expenses were $74,563,162, as against $67,481,524, and net earnings were $25,656,274, as against $28,583,003. There were 395 fatal accidents during the year. Of the total number of persons killed, 25 were passengers, 192 employees and 178 are classified as "others." The majority of these "others," to the total of 103, were killed when they were walking on the track or standing by it, and were presumably trespassers.

The statistics of the electric railways in the Dominion are also included in the report. The electric mileage completed on June 30, 1904, aggregated 767 miles, showing practically no increase from the year previous. The entire amount of capital paid on account of these lines was $50,399,188, of which municipal aid amounted to $173,000 and government bonuses paid $60,800. The gross earnings of the electric roads were $8,453,609; their working expenses, $5,326,577, and their net earnings, $3,127,092. They carried 181,689,998 passengers and also 400,161 tons of freight. Of the entire electric mileage, 376 miles is in the Province of Ontario and 254 miles in the Province of Quebec. New Brunswick, Nova Scotia, Manitoba and British Columbia have only 137 miles of line between them.

The paper entitled "The Effect of Oil Upon Portland Cement Concrete," in the *Railroad Gazette* March 17, was written by Mr. J. C. Hain, Engineer of Masonry Construction of the Chicago, Milwaukee & St. Paul. Mr. Hain's name was unintentionally omitted from the head of the paper.

Standard Bridges on the Harriman Lines.*

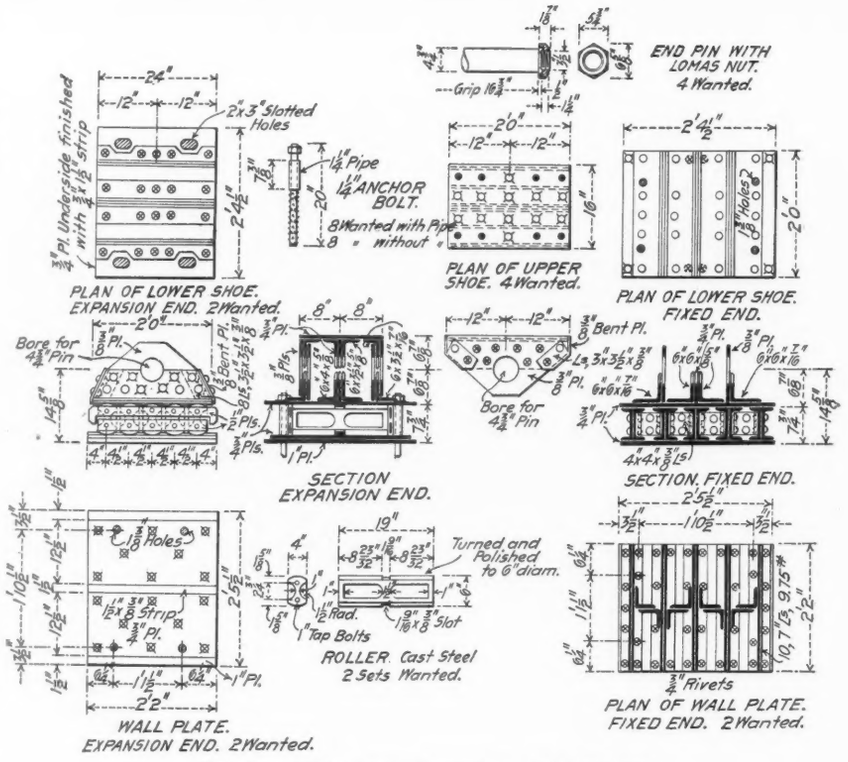
The drawings in this issue show the standard 90-ft. plate girder for the Harriman Lines. It differs from the 80-ft. girder shown last week only in the general dimensions, all the details being essentially the same. The web plate is made in six pieces and cambered



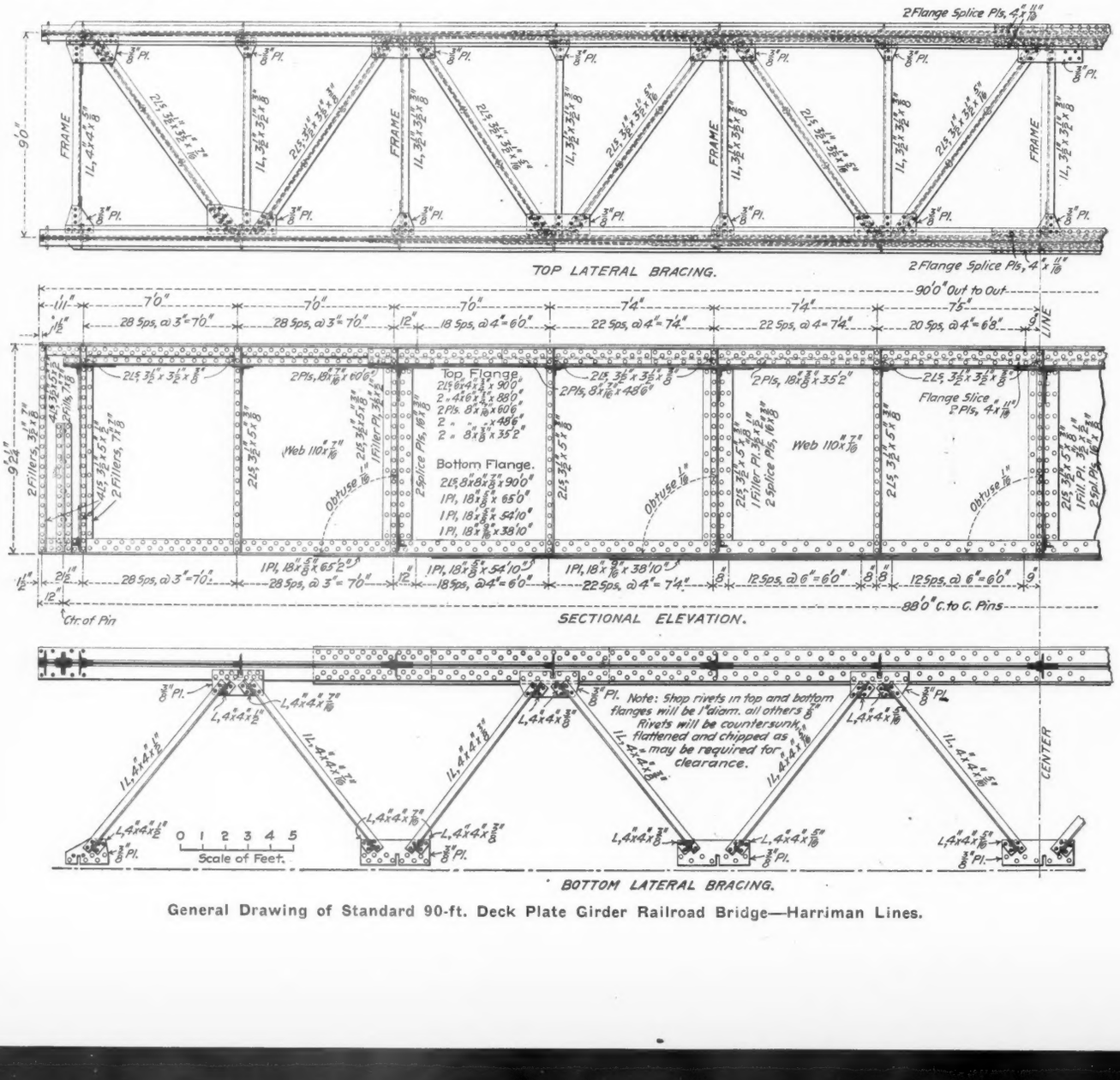
Cross Frames for 90-ft. Girder.

1/16 in. at each of the five splices. In this girder as well as in the 80-ft. girder channels have been substituted for angles in the end cross frame diagonals. The area of cross section in the top flange is 51.26 sq. in. and in the bottom flange 62.49 sq. in. One span complete weighs 113,200 lbs.

*Previous articles appeared in the *Railroad Gazette*, March 17, 24, 31 and April 7 and 14.


END PIN WITH LOMAS NUT. 4 Wanted.
PLAN OF LOWER SHOE. EXPANSION END. 2 Wanted.
PLAN OF UPPER SHOE. 4 Wanted.
PLAN OF LOWER SHOE. FIXED END.
SECTION EXPANSION END.
SECTION. FIXED END.
ROLLER. Cast Steel 2 Sets Wanted.
PLAN OF WALL PLATE. FIXED END. 2 Wanted.
WALL PLATE. EXPANSION END. 2 Wanted.

Details of Fixed and Expansion End Bearings.



General Drawing of Standard 90-ft. Deck Plate Girder Railroad Bridge—Harriman Lines.

The Miners' Union.

Frank J. Warne, Ph.D., contributes an interesting paper to the *Annals of the American Academy of Political and Social Science* on the business management of the United Mine Workers of America. The total membership of this union in the United States exceeds 300,000, organized in at least 10 of the 27 coal producing states, while about 75 per cent. of all the coal mine employees in the country are at present members of the union and more than 85 per cent. of the total of 486,000 are governed by the union scales and work under its conditions of employment. The general scheme of organization of the United Mine Workers bears a close resemblance in many of its features to that of our political organizations. It is composed of national, district, sub-district and local unions. The jurisdiction of the national union is intended to cover the entire coal producing area of the country. At present, it is effective in Ohio, Indiana, Illinois, Kansas, Iowa, Missouri, Kentucky, Tennessee, Alabama, the hard-coal fields of Pennsylvania and in portions of the central and western bituminous fields in the same state. It also extends into Maryland, Virginia, West Virginia and a half dozen other states and territories. The United Mine Workers is one of the most democratic, with a possibility of becoming all at once one of the most autocratic, organizations in the world. It is democratic in the sense that in the final analysis its policy and management is in the hands of its members. They nominate and elect the members of the national executive board. They choose the delegates that make up the national convention and send instructions to this convention. Once a year, representatives of the local unions meet in a regular convention as the national union, usually at Indianapolis, and outline the policy of the national union for the ensuing year. This convention possesses absolute power. There is nothing it cannot do affecting the organization, even to alterating its own fundamental law, the constitution.

The purpose of the national convention is to legislate on any question pertaining to the objects of the organization. These objects are expressed in the preamble to the constitution: "There is no fact more generally known or more widely believed than that without coal there would not have been any such grand achievements, privileges and blessings as those which characterize the twentieth century civilization; and, believing, as we do, that those, whose lot it is to daily toil in the recesses of the earth mining and putting out this coal which makes these blessings possible, are entitled to a fair and equitable share of the same; therefore we have formed the United Mine Workers of America for the purpose of the more readily securing the objects sought by educating all mine workers in America to realize the necessity of unity of action and purpose, in demanding and securing by lawful means the just fruits of our toil."

The stated objects of the organization include securing good earnings, abolition of any form of payment except lawful money, abolition of compulsory company shops, the introduction of life and health-saving appliances, the uncompromising demand that eight hours shall constitute a day's work, and not more than this amount of time shall be worked in any one day by any mine worker; the protection and education of children; the abrogation of all laws which enable coal operators to cheat the miners in regard to weighing coal, etc.; the securing of legislative enactments in every state to render it impossible for coal operators to employ any other forces except the ordinary forces of the state to take armed possession of the mines in cases of strikes or lockouts, and the use of all honorable means to maintain peace, adjusting differences, so far as possible, by arbitration and conciliation. The means for obtaining these ends are declared to be conciliation, arbitration or strikes. All three have been employed in the course of the union's existence.

The power of the national President of the association is shown by the fact that, when the convention is not in session, all questions rest with the officers and in the last analysis with the President, since, in case of conflict of policy, his decision is final. He has power to suspend or remove any national officer for sufficient cause, and may temporarily fill all vacancies. The constitution provides that, in the exercise of the power of removal and appointment, he shall have the consent of the executive board; but he can suspend or remove the members of this board. He has a strong influence over them in still another way: as members of the board, these officers receive no salary; but practically all of them are paid $4 a day and expenses as organizers, and their positions as organizers depend entirely upon appointment by the President. He, at present, receives a salary of $3,000 a year and is required to devote his time and attention to the organization.

No strike can be ordered by any district, nor can final action be taken upon any questions directly or indirectly affecting the interests of the mine workers of another district until the approval of the national President is secured in writing, or, he having disapproved, until favorable action, upon an appeal from his decision, has been taken by the executive board. The exception to this lies, of course, where the strike or action has been ordered by the national convention during its two weeks' session each year. Local strikes are under the jurisdiction of the district officers. Together with the other national officers, the President has the power to order a suspension of mining operations by members of the union in any district or districts where such action is deemed advisable for the settlement of a strike in another district or for the good of the union.

The investing of such great power in the hands of one man is due primarily to the exigencies of strike times, when, for all practical purposes, the union becomes a military organization, in the control of which there must not be the least possibility of divided leadership. Labor unions have been taught by sad experience, and none more so than the United Mine Workers, that an industrial army moving for higher wages and better conditions of employment must have but one commander-in-chief if the possibility of defeat is to be reduced to a minimum.

Dr. Warne describes in detail the organization and conduct of the executive board, which is chosen by the district conventions in a manner somewhat like the choosing of United States Senators by State Legislatures. The executive board, including the President, wields power next in importance to that of the national convention. In fact, it executes the orders of that convention, and between conventions, it has full power to direct the workings of the national union, including the levying and collection of assessments. Not only does it have power to order a general strike or suspension, but it can overrule, upon appeal, the decisions of district officers upon questions affecting strikes within the district. Nearly all the members of the executive board, as stated, are employed by the President as national organizers. These are the walking delegates. They bear the brunt of the fight, are always to be found in the thickest of it and generally constitute the advance guard of the field forces of the organization. When an invasion of territory heretofore unorganized is decided upon, they are the missionaries of the new doctrine as to the rights of man. They usually are compelled to blaze it forth on every hand in a wilderness of conflicting passions and class hatreds; encountering suspicion and bitter antagonism even from those they would save from industrial servitude. They go among strange peoples from many climes; they teach their doctrine of unionism to the negro, the Slav, the Lithuanian, the Greek, the German, the Englishman and the American. Through months and even years of bitter antagonism, of almost crushing opposition, they work patiently at their task to bring the many nationalities into the organization and to mould the heterogeneous into unity of belief and action.

As the machinery for the inauguration of a strike is first put in motion by the local union, so does the success of the strike depend to a large degree upon the support given by the locals, not only by those whose members happen to be on strike but by those in other fields whose members remain at work. The members of the locals constitute the rank and file of the organization—they are the privates, corporals and sergeants of the great army of mine workers moving toward an improvement in the conditions of their employment. In peace times they prepare the organization for strikes by contributing, in dues and assessments, to the district and national unions, besides providing for their own local treasuries. So well did they do this in 1902 that immediately upon the special national convention issuing its appeal for relief to carry on the anthracite mine workers strike, District 12 (Illinois) contributed $50,000 from its treasury; District 8 (Indiana), $10,000; District 11 (Indiana), $8,000; District 13 (Iowa), $5,000; District 2 (Central Pennsylvania), $3,259.50, and Districts 25 (Missouri) and 20 (Alabama), $1,000 each. Only a month before this appeal was issued District 12 (Illinois) had contributed $50,000 for the conduct of the strike in the two Virginias, making $100,000 from one district alone within two months for carrying on strikes.

When a strike of unusual proportions is in progress contributions from other labor organizations and from the general public increase the funds in the national treasury. The important part these play in the conduct of the organization was shown during the six months' strike in the anthracite region of Pennsylvania in 1902. To carry on that struggle alone, not including the expenses accompanying the strike of mine workers in progress at the same time in the Virginias, the various unions of the United Mine Workers of America voluntarily donated $258,344 and the members of the organization paid in special assessments $1,967,026, a total of $2,225,370. The total amount paid by the United Mine Workers for strike purposes, from Jan. 1 to Dec. 31, 1902, was $1,889,202. At the beginning of 1903 there was a balance in the national treasury of the union of $1,027,120.

All this indicates the importance of the financial organization of the United Mine Workers of America. This constitutes one of the strongest features of the national union. At its head is the secretary-treasurer nominated and elected directly by the vote of the members of the local unions. He conducts all the business of the organization concerning the management of national headquarters, having charge of all books, documents and effects; supervises the management of the *Journal*, the official weekly organ of the union; receives all moneys and pays all bills, excepting when the president orders otherwise, and providing that not over

$15,000 is subject to the secretary-treasurer's order at any one time. All sums over this amount are deposited by him to the credit of the Executive Board, and to draw upon these a written order of two-thirds of the board members is necessary. He is required to give a bond of $25,000. His yearly salary in 1902 was $1,500 and expenses, but it has since been increased to $2,500 and expenses. As a rule he reports quarterly to the locals the condition of the national treasury.

So well organized are the financial features of the United Mine Workers of America that the national union was able to carry on a widespread system of relief to the needy anthracite mine workers during the closing two months of the 1902 strike. In this relief work no distinction was made between union and non-union men. In fact, the testimony of many witnesses is to the effect that aid was furnished as freely to the non-union as to the union mine workers. For this relief work the members of the locals were organized into committees of various kinds. Applications for relief were investigated by one of these committees and if conditions were found as represented, orders for merchandise on local grocers were furnished.

Since the great strike of 1897 the United Mine Workers has extended the eight hour workday into the mines of Iowa, Missouri, Kansas, Michigan, Kentucky and parts of Tennessee, and has secured for the mine employees of those states increases in wages ranging from 13 to over 30 per cent. Increases in the wages of mine workers in other states have also been secured through joint conventions with the operators, and increases in wages, with improved conditions of employment, were forced from the railroad mining companies and independent operators in the three hard coal fields of Pennsylvania in 1900 and 1902. Since 1898 the membership of the national union has increased from 43,000 to nearly 300,000. Of this total membership about 185,000 mine employees, producing annually 125,000,000 tons of bituminous coal, or over one-third of the total coal production of the United States, now work under agreements. Many of the 147,000 anthracite mine workers are strongly organized in the national union, but as yet they have been unable to secure agreements from the coal hauling railroads which virtually control the mining operations. These hard coal miners produce annually about 60,000,000 tons. The remaining 115,000 mine workers of the country, producing annually about 100,000,000 tons of bituminous coal, and employed principally in the states west of the Mississippi and in West Virginia, Virginia, Michigan, Maryland and in central and western Pennsylvania, are as yet unorganized in the United Mine Workers and have no agreements with their employers.

Enough has been said to show that the management of the United Mine Workers of America is as much of a business as is the conduct of any of the great industrial or commercial enterprises of the present day. It directs its strength against those forces tending to keep down the price of its commodity—mine labor—with as much regard for its own particular interests and in disregard of the interests of others, where and when these conflict, as does any of the industrial or other trusts. In order to control the price of mine labor it aims to prevent mine workers from selling their labor at a lower price than set by the union. It does this by taking them into the organization, and persuading them to sell their labor at union prices, or by driving them out of the industry, just as the great Steel Trust endeavors to absorb or destroy the independent steel manufacturer, or as the Sugar Trust attempts to control or drive out the independent refiner. The mine worker refusing from one cause or another to be governed by the union in the sale of his labor is the independent producer of mine labor, or the non-union man. In driving out the commodity he has to sell the union is forced to attack the individual as it is impossible to dissociate the one from the other. In consequence violence and bloodshed results. Not only does the union attempt in various ways to control this independent producer of mine labor in the selling of his commodity, but not unlike the so-called trusts, in fixing the price of this labor and the conditions under which it is to be sold, it brooks no interference from other organizations which have mine labor to sell if it feels itself strong enough to prevent it. This is well illustrated by the United Mine Workers practically driving out of the anthracite fields of Pennsylvania the separate organizations of blacksmiths, engineers, carpenters and firemen which existed in one or more of the three fields prior to the recent strikes.

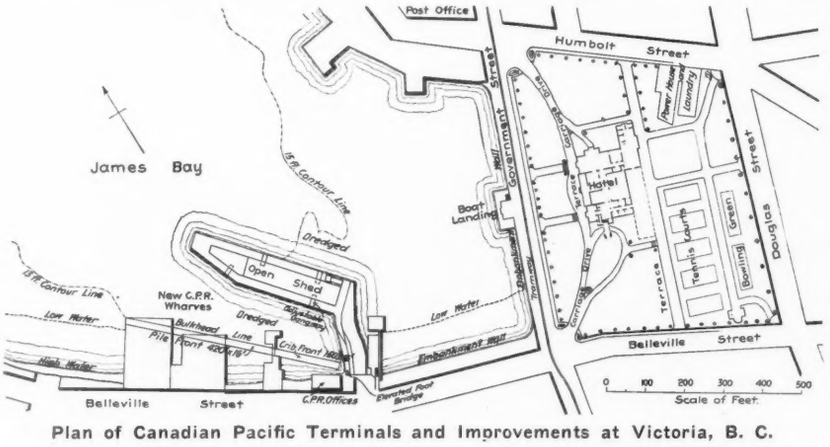
Trade unionism, under the stimulus of the United Mine Workers of America, has come to be a business operation on a large scale. As a business its success depends upon the close observance of market conditions and the obeying of laws governing those conditions. Most trusts deal with material commodities—goods that have no feeling or mode of independent action. They are thus able usually not only to increase the price of their particular commodity on a rising market, but if they so wish to reduce prices on a falling market. The difference with the trade union is that it deals with a commodity possessed by an individual with feelings and sympathies and modes of independent action. The general experience has been that when a period of falling prices sets in, the possessor of mine labor objects strongly to reducing the price of his labor—his wages. The past teaches us that he persists stubbornly, even against the advice of the leader of his union, in his refusal to reduce his wages and will go to the extent of striking against such reduction. The trade union also confronts great difficulties in raising the price of its commodity on rising markets largely due to the fact that the consumers of labor, unlike the consumers of most trust commodities, are strongly organized. The part of the intelligent labor leader—of the business manager of labor—is closely to observe the conditions of the labor and general markets and all factors likely to affect the wages of the worker—the price of labor—and to direct his organization along the lines they indicate is the proper course.

Another railroad into the heart of Africa has been begun. It is to extend from Lobito north of Benguela, on the coast of Portuguese West Africa, to Barotze, on the southeast boundary, a distance of about 800 miles. Eventually it may be extended to connect with the Central South African Railways in the interior.

Canadian Pacific Improvements at Victoria.

Victoria, situated on the southeastern extremity of Vancouver Island, is the capital and oldest city of British Columbia. At the time of the Fraser river gold discoveries in 1858 it suddenly grew from a Hudson Bay Company's post to a city of between 20,000 and 30,000 inhabitants, subsequently dwindling to a much smaller number. After the opening up of British Columbia by the completion of the Canadian Pacific Railway in 1885, it again grew rapidly, and its population in 1901 was 21,000. The city is picturesquely situated, overlooking the water of Juan de Fuca strait, with the Olympian mountains in the background. To the eastward, snow-capped Mount Baker (Washington), 75 miles distant, is plainly visible above the dark green forests of the Sound islands. The climate is remarkably equable, with no extremes of either heat or cold, the thermometer seldom rising above 80 deg. in summer, and rarely going below the freezing point in winter.

The Canadian Pacific Railway operates a line of steamers giving daily service between Victoria and Vancouver and Seattle; also steamers to Skagway and other Northern Coast ports. To provide adequate accommodation for this fleet, a large wharf and warehouse has been built, and the wharfage will be extended this year, increasing the accommodation of 50 per cent. The wharf is built of Douglas fir piling, protected from the teredo and limnoria by carbolite carbolineum. Before applying, the piles were punctured to a depth of about 1½ in. with fine slits in order to allow the composition to penetrate. The piles are generally 8 ft. center to center. The superstructure of the wharf is also Douglas fir. The main portion of the wharf is 430 ft. long by 90 ft. wide, connected with the shore by a wagon road approach, and an elevated pathway for passengers. The wharf end of the elevated footwalk is supported on a pontoon free to rise and fall with the tides, thus being always at the proper elevation for passengers landing from steamers. The warehouse on the wharf is 255 ft. by 60 ft., built of fir timber and sheathed with corrugated iron. At the entrance to the wharf from Belleville street is a two-story building, with waiting rooms and ticket offices on the ground floor and general offices for the Canadian Pacific navigation service above. These offices are directly in front of the British Columbia leg-

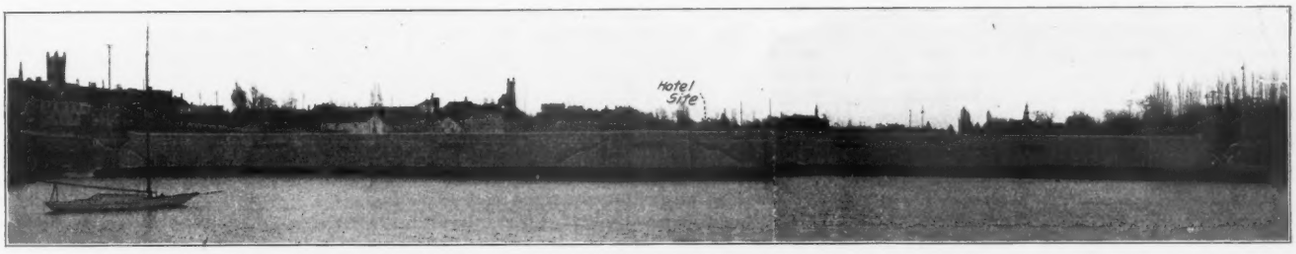


Plan of Canadian Pacific Terminals and Improvements at Victoria, B. C.

islative buildings, and on a residence street. They are built in the Queen Anne style, and present a pleasing appearance. The contractors for the wharf were Armstrong & Morrison, of Vancouver; for the warehouse, F. T. Sherborne, Victoria; and for the office building, Smith & Sherborne, Victoria.

The part of the harbor on which the wharf is situated is known as James Bay. Until two years ago the upper part of this bay was crossed by Government street, the principal business thoroughfare, on a pile structure. The part of the bay cut off being useless for shipping and unsightly in appearance, the City of Victoria built a massive masonry wall along the harbor side of the street and filled the bay behind with material pumped in by a suction dredge. This wall, which presents a handsome appearance, was designed and built under the direction of Mr. C. H. Topp, City Engineer. An agreement was made between the city and the Canadian Pacific by which the latter was granted a portion of the filled-in area on condition that a large hotel be erected thereon. The railroad company afterwards acquired by purchase some of the adjoining property in order that unsightly buildings might be removed, and also the rest of the city property on the flat. It therefore has now a block containing about 8½ acres, fronting on Government, Belleville, Douglas and Humboldt streets.

Owing to the filled-in material dredged from the bay, and the fact that the former bottom was a soft clay, it was necessary to carry the foundation of the hotel to a depth of from 50 to 60 ft. Fir piling was used, being driven to bed-rock and cut off below water level. The piles were spaced 3 ft. center to center, a total of over 3,000 piles being used. The piles are capped with concrete walls and the piers are carried up 14½ ft. above tops of piles, bringing the top of the concrete foundation 2 ft. below the level of Government street. In order to drive the piles and build the concrete, it was necessary to cofferdam the site, the dredged material being very fluid. The contract for the foundation was let to the British Columbia General Contract Company, Mr. C. E. Fowler, C. E., of Seattle, being in charge of the work for the contractors. All the work is under the supervision of the engineering department of the Canadian Pacific, with division headquarters at Vancouver. The construction of the building above the foundation has not yet been commenced. The architect is F. M. Rattenbury, Victoria.



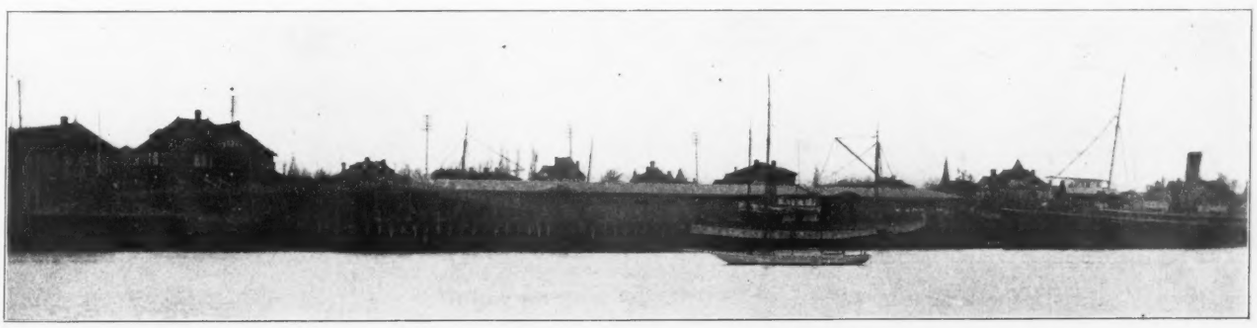
Sea Wall at Victoria in front of New Canadian Pacific Hotel Site.

Office Building and Waiting Room at Entrance to Wharf.

The basement of the hotel will be devoted to billiard, grill and sample rooms, barber shop and bar, servants' quarters and baggage rooms. The ground floor will have a clear height of 17 ft. and contain the entrance hall, dining, drawing, lounging, smoking and manager's rooms, office, palm garden, kitchen and servants' rooms. The entrance hall will have the walls paneled 8 ft. 6 in. high in Tennessee marble, with stairs of ornamental cast-iron and marble to the first floor and basement. The main dining room will be 38 ft. x 77 ft., finished in mahogany or Australian red bean. The smoking room, 20 ft. x 38 ft., will be finished in oak with the ceiling paneled and enriched. The drawing room, 30 ft. x 50 ft., and the lounging room, 25 ft. x 30 ft., will be finished in white plaster, paneled and enriched. The palm garden, 68 ft. x 46 ft., will have glass roof and plate glass sides. The first to sixth floors are devoted to bedrooms, containing 165. Except on the sixth floor, all rooms have private baths. The foundation has been built for a wing by which the bedroom accommodations can be more than doubled. The walls to the top of the basement will be granite and above this brick, faced with Haddington Island stone. The latter is the material from which the adjacent British Columbia legislative buildings were built. The hotel will cost about $600,000. Upon its completion, the appearance of Victoria from the harbor, which is now very pleasing, will be greatly improved. Directly facing will be the sea wall, already mentioned, backed by the hotel set in green lawns, while on the west will be the handsome legislative buildings, and on the east the Dominion Government buildings.

The Canadian Pacific has lately bought the Esquimalt & Nanaimo Railway, extending from Victoria northerly to Nanaimo and Wellington, 78 miles. It traverses for most of the distance a fairly well settled farming district, and at the northern end taps the coal districts at Ladysmith and Nanaimo. The Mt. Sicker copper region is reached by this line, and also several other prospective mining districts. There is a splendid supply of timber along the route. Large sawmills are in operation at Chemainus, Ladysmith and Shawnigan Lake. A smelter for copper ore is located at Ladysmith for treating ore from Mt. Sicker, and there is another at Crofton. The Esquimalt & Nanaimo operates a car ferry from Ladysmith to a connection with the Canadian Pacific at Vancouver, by means of which freight is carried to Victoria without trans-shipment.

With the possible exception of coal mining, the resources of Vancouver Island are as yet comparatively undeveloped. The value of the mineral production for 1903 was, however: gold, $285,647; silver, $111,883; copper, $908,076; coal and coke, $2,933,966; a total of $4,239,578. The greater portion of the interior of the island is entirely undeveloped and at present is almost inaccessible. There are known to be many districts of good agricultural land. The whole country is covered with a dense forest of fine Douglas fir and cedar, and what is known of the mineral resources is very promising for the



Canadian Pacific Wharf and Elevated Footwalk, Victoria, B. C.

development of copper, gold and iron mines. In order to open up the interior and northern parts of the island, the Canadian Pacific has under consideration an extension from Nanaimo to Alberni, and from Wellington to Comox. The first-named extension would reach, at Alberni, the Alberni canal, a deep inlet from the Pacific side, navigable by ships of the largest size. Steamer connections would be made there for all the west coast north of Barclay Sound, upon which are situated many copper, gold, iron and coal mines, some of which have been developed to a considerable extent. This place will be admirably adapted, when railroad communication is established for sawmills, and probably, with further development, for smelters. It may also become headquarters for deep-sea fisheries, and there is at present a small farming settlement that is capable of considerable increase. The Comox extension would pass through a fairly well settled farming country and reach the Comox coal mining district, where the mines are already operated on a large scale, the coal at present being shipped by a railroad from the mines to Baynes Sound. A considerable agricultural settlement exists around Comox, and the island to the north contains much good land, excellent timber and possibly a northerly extension of the coal-bearing formation.

For the foregoing information we are indebted to Mr. R. Marpole, General Superintendent of the Pacific division of the Canadian Pacific, and to Mr. C. E. Cartwright, Division Engineer.

Progress of Work on the New Union Station at Washington.

With the advent of mild weather work on the new Union Station and its approaches is being pushed with vigor. Fresh gangs of workmen have been employed along the line and a good start has been made for the early completion of several important portions of the construction.

On the site of the station the Thompson-Starrett Company is rushing in the foundations as rapidly as the proper hardening of the concrete will admit. These foundations are now well along toward completion, the work being confined to the last or central portions of the building. Installation of the steel work in the tunnel section is under way, about one-third of it being already in place, and the brick work on the arches to support the stone structure was begun. The filling in of the foundations on the east end of the building has been completed, the bases for the pillars are laid and everything is in readiness to erect the steel work and begin the masonry. It is expected that the setting of stone in that section of the structure will be started within a month.

The McDermott-McDonald Company, which has the contract for the construction just north of the building, are completing the last links in the retaining walls, and dirt trains are dumping in earth from the Eckington cut and the street excavations for the high viaduct. The lowering of Florida avenue, K and L streets has been effected during the winter, and that of carrying the cut of First street and M street through is in progress. The high embankment of New York avenue, which is to go over the tracks with a steel bridge beyond Florida avenue, is also assuming large proportions. The west approach is nearly finished to the line of the bridge.

The excavation of H street, the most difficult of the work of preparing the highways beneath the overhead structure, is yet to be undertaken. This street carries the car line of the Columbia Street Railway, and must be put down 18 ft. It will be necessary to lower the street one side at a time. The east side was partly excavated last fall and the work stopped by the order of the municipal authorities owing to the approach of winter. Stone laying has been going on upon the retaining walls when the weather permitted, and they are 75 per cent. done. The foundations for the Adams Express building just north of H street are also being laid. Material for the bridges over the streets has been delivered in part and work on installing it can begin at K and L streets at any time. The cutting down of the Eckington Hill, which has been going on since early last summer, is still in progress, and will be completed by midsummer. The B. & O. freight shed and sidings at Florida avenue have been occupied for three months and the new coal chutes at M street about two months.

South of the station the foundations for the tunnels are being laid across Massachusetts avenue, the section between that and B street having been completed by open cut. The contractors have built the necessary bridges and trestles to fill the plaza south of the station and earth for the purpose will be brought up from the Eckington cut. Underground work on the tunnels has been in progress all winter from the south of Capitol Hill, and the borings have now reached a point a little past the front of the Library of Congress. The engineers are meeting with fair success in the sub-surface work, and as yet there has been no disturbances at the surface.

Work in the Virginia avenue cut is now about 80 per cent. finished. Construction is going on with the south retaining wall in the open cut and in the tunnel at the east end. Work has been resumed on the Pennsylvania freight station on Maryland avenue, and the company is now waiting for a decision on some proposed changes in the plans of the overhead structures suggested by the citizens of South Washington to carry forward that part of the work. The excavations in the lower end of Maryland avenue are yet to be undertaken.

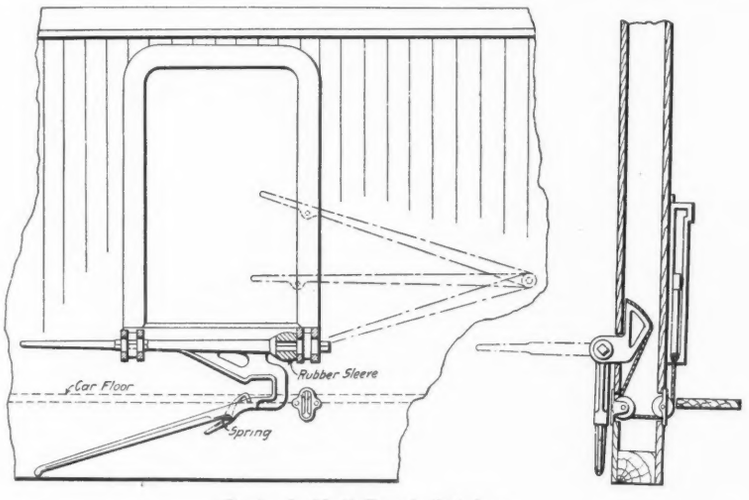
Barker's Mail Pouch Catcher.

Although the danger to men on locomotives from the earlier forms of mail cranes was considerably reduced by the introduction of schemes for swinging the arms out of the way when not carrying a mail pouch, accidents still occur to enginemen and trainmen not infrequently by being struck when the crane is holding a pouch for a "catch." It even happens that the engineman of the train which is to pick up the pouch gets struck sometimes.

To reduce to a minimum, if not to obviate altogether, the possibility of danger from this source to any one on a train, Mr. L. W. Barker, Clinton, Iowa, whose mail crane was described in the *Railroad Gazette* March 6, 1903, has devised a mail pouch catcher to go below the door of the car, requiring a reduction of the height of mail crane to correspond. The form and application of the catcher are shown by the accompanying drawings. A feature of the catcher itself is the provision for holding the pouch after it is caught. This is done by means of the latch in the outer arm, which prevents the pouch from rebounding or jumping out.

The catcher is raised and lowered by means of a lever on the wall inside of the car, shown in dotted lines, and also in the sectional view. The catcher is supported by two double-arm brackets. At the points of support the catcher arm is square in section and slips into sleeves which fit into the bracket arms. The sleeve at the right-hand side of the door has an arm projecting through a slot or opening in the car siding which carries a segmental portion or cam as shown in the sectional view. A cable attached to this latter passes over two sheaves to connection with the lever. The lever has three positions as shown, the lower one being the running position, with the catcher down against the side of the car as shown. Raising the lever to the horizontal position revolves the catcher through 90 deg. preparatory to picking up a pouch; and raising the lever to the top position revolves the catcher through another 90 deg., enabling the pouch to be removed.

The location of the lever in the car relative to the doorway would obviously be on that side away from which the door slides in opening, its movement in the illustration being toward the left. The catcher may be changed quickly to face in the opposite direction, by moving it to the left far enough to free the right-hand end, withdrawing it from the other bracket and reversing it. The rubber sleeve at the right end acts as a buffer to absorb the shock of the catch. A pin through the arm just inside of the left bracket prevents the arm from slipping forward. In the running and delivering (bottom and top) positions the lever may be secured in place to hold the catcher, but in the operating or catching position it must be held by the clerk, for obvious reasons.



Barker's Mail Pouch Catcher.

The use of this catcher enables the height of the crane to be lowered almost 4 ft., making it practically impossible for a man on a train to be struck by a loaded crane except

around the legs, unless he be standing on a journal box, or occupying some such position, as trainmen do in switching. The catcher also leaves the door opening unobstructed at all times except when in the delivering position, and minimizes the possibility of the pieces of a crane, broken in attempting a catch, flying through the doorway and injuring the clerk. Another advantage is that with the low crane used with this catcher, the pouch can be attached by a person standing on the ground.

The Valtellina Line and the Electrical Operation of Railroad Main Lines.*

BY THEODORE KÖHN.

(*Continued from page 356.*)

VI. COMPARISON OF MODES OF OPERATION BY CSERHATI AND VON KANDÓ

(*a.*) *General.*

According to past experience, the best use of the electric locomotive is for through passenger and express trains on main lines. Motor-cars are better adapted to local trains, the passengers on which take along chiefly hand-baggage.

On State lines the amortization of the cost of permanent way vanishes; that of the charges for equipment is not to be included in the estimate, because maintenance and renewal of the parts of the road's equipment must be included in the operative costs. On private lines the retiring of the construction charges may be left out of consideration as of small moment if the lines have a long franchise. In determining the interest-charges the cost of the motor-vehicles must be separated out, for they serve to replace the steam-locomotives that have been in use up to the time of the conversion, and that can be used on other lines or, according to their condition, taken out of service, and be replaced gradually with electric motor cars either charged to renewals or taken out of receipts of operation.

Hence there remains to be considered for estimating the expenses only the interest on the cost of equipping the power-station, the current-supply line and the transformers. But in making a comparison these cannot be added to the motive charges since there will be occasioned on the one hand savings in costs of operation and maintenance, on the other an increase in income due to electric operation which for estimating are to be considered as offsetting this interest.

(*b.*) *Cost of Moving Trains.*

1. Consumption of power.—Careful tests on the Valtellina Line show the current used to be equivalent to 33.5 k.w. hours, per 1,000 ton-kilometers, at the generating station switchboard; this figure includes all line, transformer and motor losses.

The costs of generating and transmitting the current are as follows:

Charges in power station for attendants, inspection of canals, lubricants, maintenance of turbines and generators, maintenance of hydraulic equipment	27,540 m.
Charges for employees to inspect and maintain conductors, transformer-tenders, supplies for up-keep of line conductor equipment	27,540 m.
Together	*55,080 m.

*These figures apply to the first part of time of operation, when less trains ran than now.

The average daily consumption is 9,600 k.w. hours, or annually 3,504,000 k.w. hours; hence a kw. hour costs 1.57 pfennigs and 1,000 ton-kilometers, 52,642 m., while previously the coal consumption of steam locomotives on this line amounted to 1.91 m. per 1,000 ton-km. on the average.

*Translated from the *Organ für die Fortschritte des Eisenbahnwesens*, November, 1904.

Since twice the current can be generated and twice as heavy a traffic can be handled without increasing the employees in the power house or on the line, the charges would be still lower for full use of this equipment.

2. Weight of the locomotives.—For electric locomotives 25 to 30 per cent. of the adhesive weight can be figured as drawbar pull, hence for freight trains the locomotive requires little ballast.

The most favorable conditions for electric transportation of passengers come when no locomotives are used, but motor cars instead, because then only their electric equipment needs to be considered. This weight on the cars of the Valtellina Line is 20 tons, yet they can develop 600 h.p.

3. Recovered Energy.—Trains descending grades greater than .4 per cent. return into the line as electrical current, a part of the work done in lifting them without any complication in the equipment or manipulation. "Cascade" connection may be used to advantage on city lines with heavy traffic where the trains stop and start often.

(*c.*) *Maintenance.*

1. Locomotives.—Steam locomotives suffer from dust, sand, rain, snow, and when running without steam also from having soot and ashes get into the cylinders from the smoke-box. The stationary steam engines and generators of a power station operphase motors of the electric vehicles so thorate in rooms free from dust and well lighted; fuel.

The mode of construction of the three-phase motors of the electric vehicles so thoroughly encloses their most sensitive part—the winding—that neither oil nor water can penetrate; only the two bearing shells, the three slip-rings and their brushes are subject to wear, which is very slight because they also are protected against dust and dirt. Occasional repairs do not take much time because all parts are interchangeable. Wheels and pinions of the connection between motor and wheel are hardened and ground. The variation of torque on drivers of steam locomotives causes tires to be unequally worn; the wear on tires of electric locomotives is less, and equal. Locomotives and tenders have wheel-brakes; on the electrics braking is replaced by cascade-connection of the motors, the wheels are braked only at stopping, hence the wear is much less.

Careful estimates show that the maintenance charges of the electric locomotives per locomotive kilometer will amount to 2.55 pf. against 7.65 pf. for steam locomotives; this will make the repair shops smaller and simpler than the present ones, and for equally long lines and equally heavy traffic fewer electric locomotives will be needed because of the fewer repairs.

2. Maintenance of cars.—Because of gentle starting, less frequent braking and absence of smoke the cars will be more protected in electric operation.

3. Maintenance of way.—For equal capacity the total weight of electric locomotives is less than that of steam locomotives, and the number of driving axles not so limited, as on steam locomotives the connection can hardly extend over four axles. The wheel pressure of the electric locomotives will therefore be less, the springs will not need to be so short and stiff as on the driving and running axles of steam locomotives.

Service in tunnels and their maintenance will become easy and cheap with the absence of smoke, the expensive ventilating appliances—dear both to install and to operate—are unnecessary, and the rails are not subject to the dangerous acid-action.

(*d.*) *Expense of Manning Locomotives.*

On the Valtellina Line the firemen on steam locomotives have proved best as car and locomotive motormen; also all conductors were trained in handling the electric appliances, so that there is a second officer at hand who can replace the motorman. On electric locomotives and motor-cars the operators are protected from the weather in closed compartments; labor is hardly called for on their part, so that they have greater capacity than on steam locomotives. According to experience on the Valtellina Line the enginemen daily run 250 to 300 passenger-train kilometers, despite the shortness of the line, and some 200 freight-train kilometers. Thus with greater protection the electric operation permits of a reduction in crews.

(*e.*) *Advantages of Electric Operation to Traffic.*

1. Safety of operation is greater with electric than with steam traction, because the train can enter or leave the station only when the official on duty has connected the respective lines into circuit, with proper position of signals.

2. Because of smaller charges for operation and maintenance, more dense traffic can be secured with light, faster trains, and travel stimulated. Absence of stops for water favors this increase still more.

High speed steam locomotives are heavy because of the large boilers, thus reducing the useful tonnage of trains and necessitating heavy roadbed construction. This heavy pressure per axle is not absolutely necessary on electric locomotives, because the number of axles is not so closely restricted. Hence on existing rails, the trains can within limits of economical operation and safety run faster, at a speed of 100 to 120 km. per hour.

3. Illumination and work for auxiliary purposes.—On electric roads the electric lighting of trains and stations follows as a matter of course. Since the act of starting of the trains causes marked variations of voltage in the conducting system, it is advisable to do the lighting of the larger stations by transformers and feeders. The main current can be used to operate cranes, hoists, rolling platforms, turntables, and where desirable the machines of the shops and railroad appliances.

4. Sparks.—The considerable payments of damages for fires from sparks thrown into woods, fields, buildings and industrial plants vanish.

5. Freightage on coal.—The power stations arranged for steam can often be erected near coal regions, whereby the haulage for coal supply is reduced, since a power house commands about 200 km.

(*f.*) *Speed.*

The attainment of high speeds causes no such difficulties as with steam locomotives, where weight and troublesome vibration increase with the speed. The limiting speed is fixed entirely by economical considerations, for when the speed is increased above a certain limit the gain in time is only slight, but the difficulties of operation are made much more serious, since the resistances increase and the wear on rolling stock and track becomes much greater. To maintain the reliability of service, which is affected by these things, it does not seem advisable to raise the speed beyond 120 km. per hour, unless recourse be had to means which are now unusual.

(*g.*) *Utilization of Water Powers.*

Where there is a water power available without too great expense, this will be used for generating power. But electrical operation is also economical when the power is generated by steam. From very carefully made calculations the cost per h.p. hour at the periphery of the wheel is less on lines with dense traffic for electric traction than

for steam, aside from all the advantages already noted of electric operation.

In case the capacity of the individual power houses rises to 1,500 h.p. or more, it will be practicable to put boiler and engine rooms under charge of experienced engineers. The firing in the boiler room will then not be entrusted to a few firemen, but all the resources of science may be applied for discovering and immediately remedying any shortcomings.

(h.) Summary.

Cserháti and von Kandó sum up the advantages of electrical operation as follows: "Possibility of utilizing water powers or saving in fuel; lighter locomotives, having less self-resistance; partial recovery of work in lifting, on mountain roads; cheaper and easier maintenance of operative parts, also fewer locomotives and smaller shops; less wear on cars; decreased labor-cost by absence of fireman or engineer; greater reliability, possibility of dense traffic with light trains; higher speeds on existing way, convenient illumination of stations and trains; absence of smoke and sparks."

Against these advantages there is a not inconsiderable supply of capital required for costs of installation. But the question of securing funds cannot be raised as an objection against electric operation. Just as in the case of the Valtellina Line a company can be formed for the work of converting the line to electric operation; no expenditure will then fall to the owner of the road, for the charges to be paid to the operating company will be covered by the savings. Another solution would be for the owner of the road to defray at his own expense the cost of electric installation, and to procure the electric locomotives as an advantageous substitute for the old steam locomotives, which would be retired from service, the charge being made to operative costs. The delivery of current might be by contract if the road-owner did not wish to erect his own power house.

(i.) Adaptability of Roads for Electric Operation.

Electric operation will prove more economical than that with steam engines only when both the passenger and freight traffic are developed by division of the former among small trains running at higher speed, and the latter, which forms the chief item of income, by introducing heavier and faster freight trains.

But this will count only on roads with dense freight and passenger traffic, not on small or branch lines, where the increase to be expected in traffic would not pay the interest on the cost of the electric equipment. Hence each line, especially if a new one, must be specially investigated with regard to its commercial fitness for electric traction.

In general, the following roads will be adapted for electric traction:

Roads having enough water power at hand to operate them.

Roads in coal regions, where cheap coal and culm can be used for steam.

Mountain roads, where the work done in ascending can be partially recovered in descending, especially in combination with the first two conditions.

Urban and suburban roads with dense traffic.

Single track roads, on which increasing traffic would demand a second track, if the electric operation with heavier trains and higher speed obviates the second track.

(To be continued.)

Reducing Noise on the Chicago Elevated Roads.

The first part of Mr. Bion J. Arnold's report to a committee of the City Council of Chicago, which was reprinted in the *Railroad Gazette* March 31, dealt with means of increasing the capacity of the Elevated Loop.

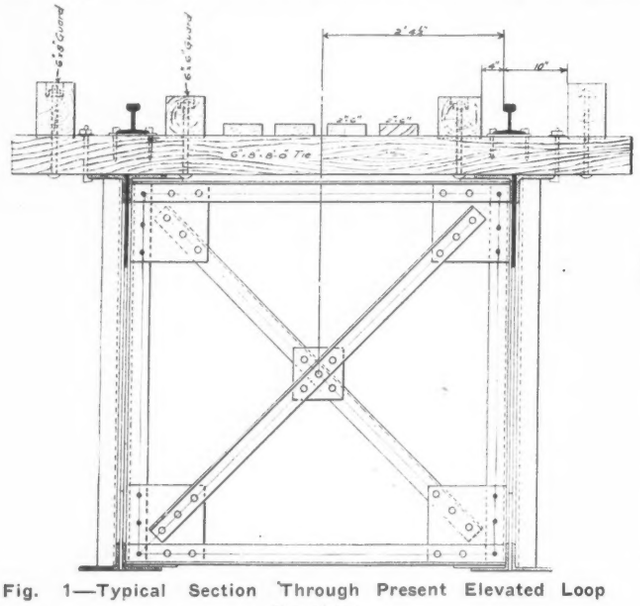


Fig. 1—Typical Section Through Present Elevated Loop Structure.

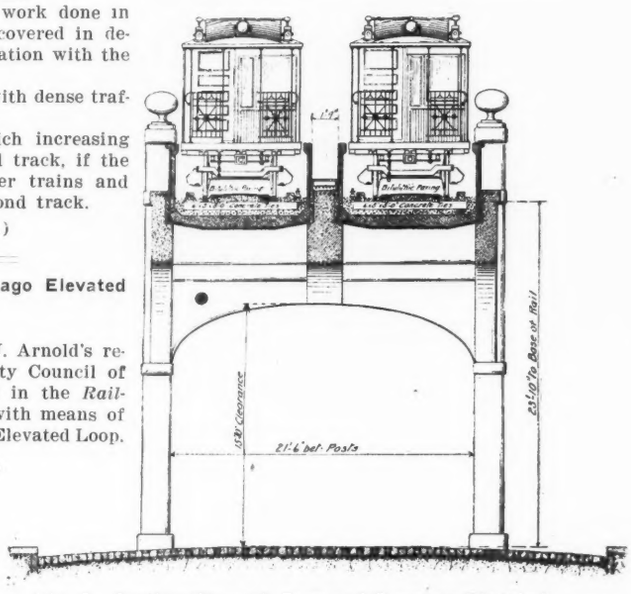


Fig. 2—Section Through Proposed Concrete Elevated Structure with Solid Floor.

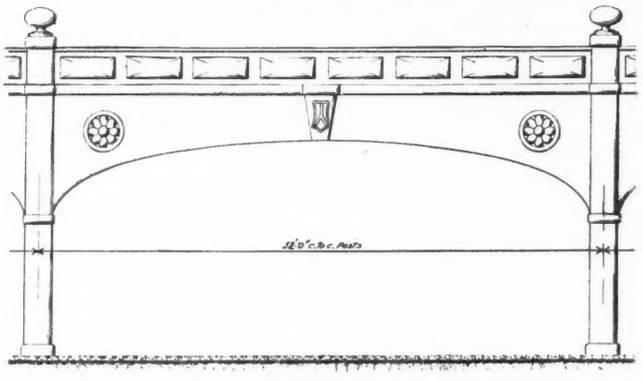


Fig. 3—Side Elevation of One Span of Proposed Concrete Elevated Structure.

The second part of the report takes up the interesting subject of proposed means for decreasing the objectionable noise caused by the operation of trains on the elevated structure.

The present steel structure of the Union Elevated Loop in Chicago, while well designed from a structural standpoint, shows that little consideration was given to the problem of noise, which makes it difficult to reconstruct it in such a manner as to apply what is now known regarding sound deadening without expending a great deal more than it would have cost had the subject been given careful consideration at the time of construction.

A typical loop span comprises latticed deck, longitudinal trusses, semi-latticed girders, and riveted posts; Fig. 1 shows an enlarged tranverse section with detail of floor. It will be seen that the rails rest immediately upon ties which, in turn, are rigidly secured to the upper chords of latticed steel trusses, thus giving the best condition that could have been devised for imparting the hammer blows, caused by the wheels upon the rails, directly to the structure, unless the rails had been placed immediately upon the upper chords or upon a metallic support between the rails and the chords. While this construction is not questioned from an engineering standpoint, for it is well designed, attention is called to it to show some of the difficulties that will be encountered in attempting to modify it so as to deaden the sound to such an extent as may be found practicable. Were the present structure not in place, I am firmly of the opinion that a concrete structure could be designed and built which would prevent to a large degree the noise now emanating from the present steel structure, for a cost which would not be greatly in excess of the cost of the present structure, but to change the present structure into one of concrete would be a difficult and expensive task.

In analyzing the relative merits of different classes of construction, the fact should not be lost sight of that the noise comes primarily from the trains, and a large part of this noise cannot be eliminated entirely no matter how good the design of the structure, and the best, therefore, that can be expected is to minimize the noise caused by the operation of the trains, to the greatest possible extent, and prevent its being inten-

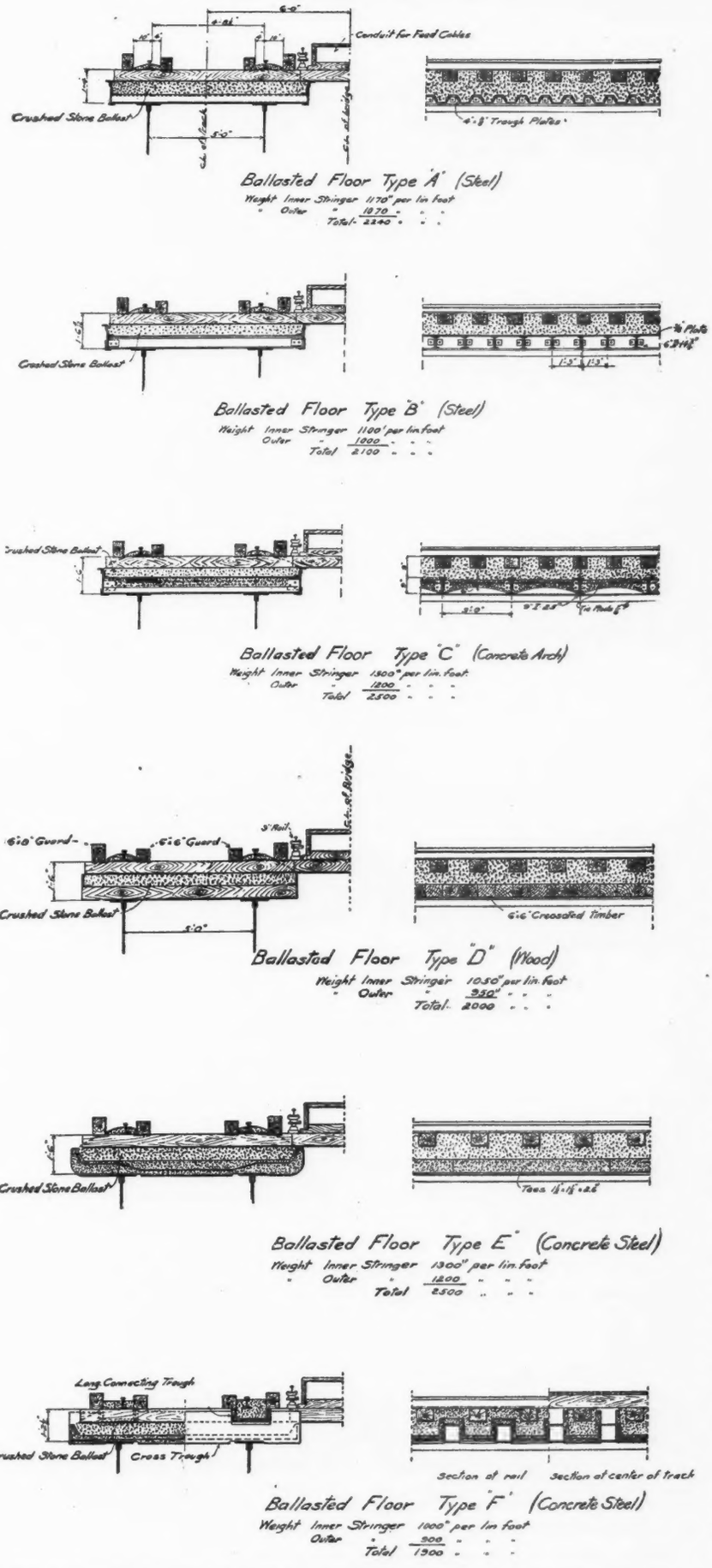

Conduit for Feed Cables
Crushed Stone Ballast
6'-8" Trough Plates
Ballasted Floor Type "A" (Steel)
Weight Inner Stringer 1170" per lin. foot
" Outer " 1070 " " "
Total 2240 " " "
Crushed Stone Ballast
Ballasted Floor Type "B" (Steel)
Weight Inner Stringer 1100" per lin. foot
Outer " 1000 " " "
Total 2100 " " "
Crushed Stone Ballast
Ballasted Floor Type "C" (Concrete Arch)
Weight Inner Stringer 1300" per lin. foot
Outer " 1200 " " "
Total 2500 " " "
6'-0" Guard
6'-6" Guard
Crushed Stone Ballast
6'-6" Creosoted Timber
Ballasted Floor Type "D" (Wood)
Weight Inner Stringer 1050" per lin. foot
" Outer " 950" " " "
Total 2000 " " "
Crushed Stone Ballast
Ballasted Floor Type "E" (Concrete Steel)
Weight Inner Stringer 1300" per lin. foot
" Outer " 1200 " " "
Total 2500 " " "
Long Connecting Trough
Crushed Stone Ballast
Cross Trough
Section at rail
Section at center of track
Ballasted Floor Type "F" (Concrete Steel)
Weight Inner Stringer 1000" per lin. foot
Outer " 900 " " "
Total 1900 " " "

Fig. 4—Details of Proposed Solid Floors Suitable for the Elevated Loop Structure.

sified by the supplemental action of a vibrating or ringing structure.

The use of concrete would eliminate almost all of the difficulty encountered with the present structure due to vibration, and if, in addition, the structure were carried up solid on each side of each track to a point slightly above the bottoms of the cars as shown, the noises produced by the wheels upon the joints and by other working parts of the train would be largely confined to the space underneath the train, and would to a certain extent dissipate themselves and be prevented from being immediately transmitted in a horizontal plane to the sides of the tall buildings on each side of the structure, thence upward, to the annoyance of the occupants of the upper stories as at present. This class of construction might be objected to owing to the fact that it would introduce difficulties in removing ties; but in answer to this it may be said that the subway in New York, as well as the Berlin Elevated Road and others, have this objection in a greater or less degree, so that it should not be considered prohibitive if, by its adoption, other advantages could be gained.

Furthermore, the ties on an elevated structure should last many years and the use of concrete steel ties, similar to those now beginning to be used on steam roads, would almost entirely eliminate this objection, as they would seldom have to be renewed.

Since it would be manifestly unjust to ask that the present loop structure be removed, and thus permit the erection of a design of this character, the problem then is how best to modify the present design so as to reduce the noise to the greatest possible extent without making the cost prohibitive.

There are four primary causes of the noise on the Loop, which are as follows:

1. Imperfect track construction.
2. Imperfect rolling stock.
3. Imperfect roadbed.
4. Defects in structure: a. Elasticity of the steel; b. Lack of rigidity.

Imperfect Track Construction.

The track when built in 1895 was laid with 80-lb. steel rails upon light tie plates, and provided with all necessary special work for operating the trains in and out of the Loop, and so long as the joints of the track remained new and in good condition the noise was not excessive, after the inequalities incident to the opening of a new line of track had worn off, except at the junction points and on cross-overs where many frogs and switches were necessarily placed. As the track became worn and the joints became hammered, the noise began to increase, and it has continued to increase until the present time, when it is almost unbearable in certain places and especially at the junction points. The present condition of the track is largely due to the failure of the tie plates which proved to be too light for the duty imposed upon them.

As the hammering of the wheels over the joints is the chief source from which noise is imparted to the structure, it is of vital importance that these joints and the entire track be built in as thoroughly first class manner as possible, and maintained in this condition. It seems almost impossible to procure a type of joint over which a heavily loaded wheel will pass without imparting to the rail a blow sufficient to produce sound of considerable magnitude, and in time cause a hollow place in the rail upon which the wheel strikes after leaving the joint.

I believe that the most practical thing to do under the circumstances, in view of the fact that the present rail is badly worn and would have to be renewed before experiments with any new type of rail could be conducted, during a sufficient length of time to determine its practicability, is to use the Am.

Soc. C. E. standard section, re-rolled steel T-rail, weighing not less than 80 lbs. to the yard, having the ends cut at an angle of about 40 deg., and provided with some first class joint of the bridge type, such as the Continuous, the Weber, or other equally good joints. This form of joint is not new and has been used by various railroads, and especially by the Lehigh Valley, where it was known as the Sayre joint, for a period of about 12 years, and to a certain extent by the Buffalo, Rochester & Pittsburg. While it has been abandoned by the former road, due probably to the fact that the advantages gained in steam road service were not considered as sufficient to pay for its increased cost, I believe it to be the most practical thing to adopt in this case at present, for, by its use, it will be possible for the Union Loop Company to equip its road during the coming summer with new rail and thus at once eliminate a large part of the present noise. If this type of joint is used, the rails should not be over 45 ft. long, on account of expansion difficulties. It is important that the joint be made with shoulders on the rails, thereby removing the sharp points.

If there were sufficient time to secure special rails, there is one other type of joint which would do good service. This is known as the scarf joint, and is the standard joint used by the Prussian State Railways for a number of years, and at present used on the Berlin Elevated. In its best form, however, it necessitates a specially rolled rail, with the web eccentric or off-center of the rail, this construction permitting the rails to be alternated and allowing the webs to lap at the joints, thereby making a stiff, substantial joint, and, at the same time, providing a practically continuous rail for the wheel when passing the joint. This form is used on the Berlin road, and is there known as the Haarmann-Vietor rail.

All "special work" not absolutely necessary for the proper operation of the trains should be removed, and worn special work now in place (and ultimately *all* the present special work) should be replaced with the best and most improved type of manganese steel special work, which, although very expensive, lasts so much longer than ordinary special work that, under the conditions existing on the Loop, it is advisable to use it.

All frogs should be of the movable point type where conditions will permit or of a type which will offer as nearly a continuous rail as practicable for the rails over which the wheels are passing.

In order to make the rail and its support a unit, all rails should rest on large and heavy tie plates and be secured to the ties by means of screw spikes or otherwise in such a manner as to prevent the rattling of the rail and plates, and be maintained in this condition.

Imperfect Rolling Stock.

The rolling stock in use on the Union Loop consists mainly of rather light cars with open running gear. Since a large part of the noise proceeds from the running gear, it is important to apply some preventative for this, either on the cars or on the structure. Unless the railroad companies will maintain the cars and running gear in good condition and thereby prevent much of the present noise from this source, some method of enclosing the entire truck, including the wheels, with a light casing of sound deadening, non-combustible material, such as asbestos sheeting, should be tried. This casing should come as close to the guard rails as practicable and clear the third rail, so as to intercept as much of the noise from the wheels as possible. It should have a bottom, and the sides should be hinged to permit inspection.

A truck casing of this type should, to a considerable degree, smother the noise due to brake-beams and shoes, defective gears, rattling of bolts and rivets on trucks, etc., which is particularly annoying at times, and also in a large part the noise resulting from the impact of the wheels on the rails. From an operating standpoint this is an objectionable thing to do, for the reason that inspection of the truck and motor parts would be made more difficult and the capacity of the electric motors would be reduced owing to their enclosure. Careful inspection and the prompt renewal of all defective and badly worn parts would largely remove this source of noise and, by adopting side walls on the structure as hereinafter described, the noise would be rendered less objectionable.

The Northwestern and Chicago & Oak Park roads use single motor cars on their trains, which method of operation imposes upon four sets of motor gears the entire duty of accelerating any train, no matter how heavy. This results in excessive gear noise on heavy trains, which could and should be eliminated by the adoption of the multiple unit system, which provides each car with its own motors and thereby imposes less duty upon individual gears. Furthermore, the average speed of the trains could be increased by its adoption.

The latest types of cars used for intramural transportation, such as those recently put into service in the subway by the Interborough Company of New York, are provided with sound deadening material in the hollow spaces of the floors and sides. There are several fireproof substances that can be used for this purpose, and all new equipment purchased by the elevated roads of Chicago should have all hollow places filled with some such material. Such of the present cars as have no sound deadening material in them should have the hollow spaces filled with mineral wool, asbestos or some other light, non-combustible material.

The present cars and trucks should be put in first class condition and kept so, and all future cars should be equipped with trucks having as few parts as practicable.

The relief opening of the triple valves of the air-brakes should be provided with some device for muffling the noise of the escaping air when the brakes are released and thus prevent the sharp whistle now common to some of the cars. This can often be accomplished by changing the size of the orifice.

Imperfect Roadbed.

As has been previously pointed out, the roadbed of the present structure, though satisfactory for railroad operation, is defective from the standpoint of sound deadening, and in order to remedy this defect as far as practicable some type of ballasted floor must be used. This might involve the reinforcement of the loop structure to provide for the added weight, and this reinforcement governs the selection of the type of floor to be adopted. Considerations of cost, maintenance, interruption of traffic and cutting off the light in the streets below, as well as the difficulties attending the alteration of the existing structure, enter into the problem.

Ballasted floors have been used in this country, and especially in the vicinity of Chicago, by different steam railroads in crossing streets on viaducts, the ballast generally being supported on steel trough plates or I-beams with steel plate decking. In some instances creosoted plank has been substituted for the steel decking, and in some types the ballast has been omitted altogether, as in the case of the first track on the New York Central viaduct.

In order to compare the various types of floor construction, six such ballasted floors applicable to the loop are shown in Fig. 4, designated as Types A, B, C, D, E and F. These types have all been designed to support a single track only, leaving an open space between tracks for the feeder conduit and third rails, except at crossings, turnouts and junction points, where the floor would extend across this space. All floors have been figured for 12 in. of broken stone ballast, weighing 140 lbs. per cu. ft., and providing for 6 in. of ballast under the ties. Types A and B are what may be termed ballasted steel floors. Type C is a ballasted, concrete-arch floor, and type E a ballasted, concrete-steel floor resembling the latest type adopted by steam railroads for bridges. All of these are "solid" floors—that is, they form a continuous decking under the track. Type F is a type of open ballasted concrete steel floor.

The effect of the ballast as used in these various types would be a cushioning of the rails, and a reduction of the impact due to the cars, improving the riding qualities of the track, reducing the noise and increasing the durability of the structure. By carrying the ballast up and around the rails the noise due to the singing or humming of the rail would be greatly reduced.

In respect to cost, types A and B involve drilling of many holes and much field riveting; type C likewise involves such work, but to a less extent, the gain, however, being offset by the cost of the forms required for the concrete arches. Type D has but little field work, but in order to insure durability the timber must be treated, which increases the cost and removes the main argument for its adoption. Types E and F are the cheapest floors both in first cost and maintenance.

Experience in the application of ballasted floors to railroad bridges has shown that the track maintenance has been reduced to such an extent that the saving is more than sufficient to pay the interest on the increased investment, made necessary by its adoption.

Where the weight of a floor is not excessive, such as types D and F, it is probable that the reduction of impact, due to its distribution by the ballast of the floor, would so far reduce the overstress in the members of the present structure as to make its reinforcement unnecessary, although this would somewhat reduce the present factor of safety.

The wooden ballasted floor similar to type D is now in experimental use on a section of the Boston Elevated Railway, with marked effect toward deadening the sound.

The ballasted steel floors are objectionable because they add to the amount of metal in the structure. This not only increases the noise due to the steel in the structure itself, as will be explained hereafter, but it likewise adds to the cost of painting and maintenance. Steel thus used in a ballasted floor is exposed to deterioration from the water, oils and greases which find their way to the bottom of the ballast.

The concrete floor, on the other hand, is free from these objections, being, in the first place, practically inelastic, and therefore almost noiseless in itself, and, secondly, being proof against deterioration from any of the agencies herein referred to. Type E would probably be made in 6-ft. sections weighing about 4,000 lbs. each, and is adapted to be constructed in any convenient shop near the site, allowed to set and erected in place as required. This would avoid all work in the field except placing and setting, and thus greatly expedite the work and reduce the cost.

Type F is in some respects an improvement on type E. While the amount of concrete is about the same, the individual cross troughs weigh only 1,000 lbs. each, which facilitates handling and setting. The field work embraces the bolting of the connecting longitudinal troughs to the cross troughs, and the placing of this floor in position would require the least time and therefore involve

the minimum delay to traffic. An important advantage of this floor is that there is a 7-in. opening between each cross-trough, which would admit light to the street below and allow snow falling on the structure to be handled as at present. In types E and F hook bolts would be provided for securing the concrete to the structure.

The drainage of the type E ballasted floor would be best provided by means of holes at suitable intervals toward which the floor slopes, discharging into ducts carried to the ground at convenient points, while that for type F would be made through suitable openings in the bottoms of the concrete troughs. The fastening of the guard rails to the ties could be lag screwed or could be effected by means of angle clips bolted to the guard rails and spiked to the ties. There would be no great difficulty in removing the ties in any of these floors, except where side walls are provided, and in this case openings could be made for the removal of ties if necessary.

The principal objection, aside from its cost, that is usually brought against the use of a solid floor in a city street is the difficulty of removing snow from the track.

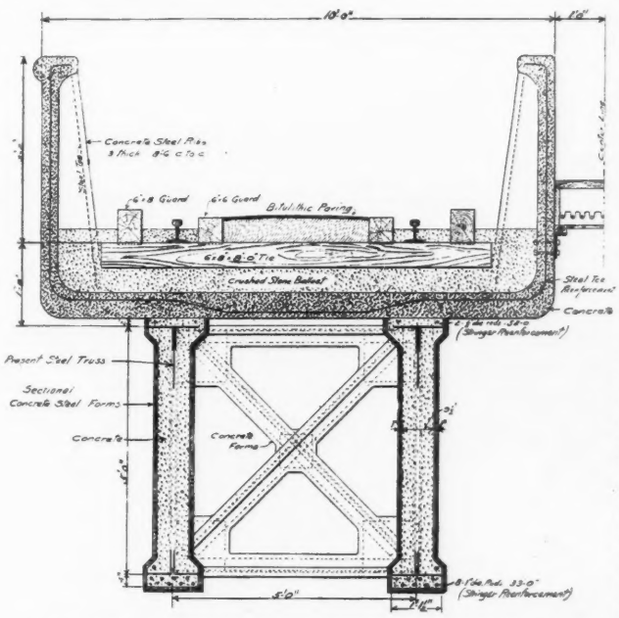


Fig. 5—Section Through Recommended Type of Solid Floor, Concrete Reinforced Structure for Elevated Loop.

While it is admitted that this difficulty is more serious with a solid floor than when an open type of floor is used, it is not insurmountable, since the Berlin and Liverpool roads, a portion of the Boston Elevated, and the Park avenue viaduct of the New York Central, have been successfully operated, and this objection should not be allowed to prevent the adoption of some type of solid floor if it proves efficient in reducing the sound. A type of snow plow or snow collecting device could be perfected which would effectually remove the snow by collecting it and carrying it away in case it became necessary to operate the loop with a solid floor.

The most important characteristic of these floors is their increased weight, as compared with the present floor, the greatest increment being 1,680 lbs. per lineal foot of track for type E and the least 1,080 lbs. per lineal foot for type F. This additional weight increases the stresses in the structure throughout and necessitates its reinforcement to secure a corresponding increase in its strength depending on the reduction of impact due to the use of ballast.

Careful calculations have been made of the stresses in stringers, cross girders and posts, for each of the different types of floors, assuming the weight of ballast at 140 lbs. per cubic foot. These calculations show that the chords in the center panels of the stringers are weak, the greatest overstress being 40 per cent. for type E floor and the least for type F floor. In the cross girders the overstress in the chords of the center panel is 69 per cent. for type E and 45 per cent. for type F. The percentage of overstress in the posts is 24.4 per cent. for type E and 18.1 per cent. for type F. The large overstress in the cross girders is due to the absence of the web plate at the center.

In making these calculations, a typical 52-ft. deck span has been taken, together with a typical cross girder and pair of posts. In estimating the cost, the reinforcement for floor types E and F has been worked out in detail for the reason that these types seem best adapted to meet the requirements, but for the purposes of comparison the costs of one of the steel floors and the wooden floor are also given, based on the cost of reinforcement required for type E. The cost in each case has been reduced to lineal feet of double track, and to provide for curves, crossings and junction points has been increased by 25 per cent. From this the total cost of reconstruction of the entire loop has been deduced.

Two kinds of reinforcement have been calculated, one a usual steel reinforcement and the other a concrete-steel reinforcement. The steel reinforcement involves a large amount of drilling, cutting out of rivets and riveting, which must be done in the field under difficult conditions. The concrete-steel reinforcement, on the other hand, requires no alteration in the metal work and can be applied without difficulty. Its greatest advantage over steel, however, is in removing the two elements of the third cause of loop noise, as will be referred to hereafter.

In applying the steel reinforcement, plates are added to the top and bottom flanges of the stringers and cross girders and to the inner faces of the columns, to bring these various members up to the section required by the increased weight of the ballasted floor. These plates would be dimensioned and punched in the shop, but the necessary holes for connecting them to the structure would have to be drilled in the field. Special work would be required at the foot of the columns on account of the concrete-filled, cast-iron fenders.

In applying the concrete-steel reinforcement, the stringers, cross girders and posts of the structure would be encased in concrete, in which steel bars would be imbedded wherever necessary to make up the deficiency in section, and also to carry the weight of the concrete itself and to support it in place. The steel would require no connection to the structure, thus avoiding to a large extent the difficulty at the fender-castings in case steel reinforcement was used. The adhesion between the concrete and the present steel structure would not be depended upon for the reinforcement but would obviously furnish an additional increment of strength. To still further reduce the noise producing effect of the steel structure, it would be best to encase the laterals and transverse bracing.

The reinforcement should be applied by means of concrete steel forms, which would serve as a facing and remain in place when the work was completed. These forms should effectually prevent any disturbance of the concrete while setting. After setting, and when the bond between it and the steel became established, it is probable that no force which the structure will bear would separate them.

This construction is what is known as a combined concrete-steel construction, one of the forms of concrete-steel design which has been tried in practical railroad work, and which is generally credited with possessing greater durability than steel. As applied here, it has a precedent in the reinforcement of old girders on the Wabash Railroad, which is carried out on somewhat similar lines. In various forms it is successfully used in floor systems and bridges of the C., B. & Q., the C. & E. I. and the C. & W. I. Railroads, as well as others, and it seems to have been demonstrated that it does not disintegrate or suffer under the influence of heavy engine loads at high speeds. Under the comparatively light loads and low speeds used on the Union Loop, the concreting in both the floor and reinforcement, if properly done, should outlast the usefulness of the structure itself.

As regards expansion, it is believed that there would be no difficulty in providing for whatever expansion might occur. Steel and concrete expand and contract at about the same rate, but the greater volume presented by the concrete reduces the effect of temperature changes and consequently lessens the actual change in length and simplifies the necessary provision therefor. Likewise the deflection of the steel girders is greatly reduced by the presence of the concrete. And since experiment and experience both demonstrate that concrete follows steel close to its elastic limit, there is no reason for anticipating serious difficulty from cracking, provided the concrete is allowed to set before live load is applied to the particular section under treatment. Aside from its value as a reinforcement and in eliminating the noise of the steel it encases, the concrete reinforcement would serve as a preservative of the present steel structure.

Further advantages of the concrete-steel reinforcement are, that it gives a desirable excess of strength and that it lends itself to some ornamentation, while at the same time it allows the enclosure of each track on the sides, as previously suggested. The sides next to the cable conduit would be provided with staggered openings at suitable intervals to allow trackmen to use the cable housing as a refuge platform from trains as at present.

In Fig. 5 is shown the detail of the application of this reinforcement to the loop structure. The added weight due to the enclosing parts would not require additional reinforcement, as the amount of concrete which it is necessary to apply to enclose the present structure gives an excess of strength, as hereinbefore stated. These enclosures and ornamentation would increase the cost to some extent, but it would still be less than would be required with steel reinforcement. It should also be remembered that these enclosures add to the safety of the structure as regards derailment.

The following table shows the cost of applying the various types of floors discussed, including the two different forms of reinforcement as well as the cost of blocking up the present floor during reconstruction, the necessary track work on the new floor, and

a percentage for engineering and contingencies.

It will be evident from these tables that types E and F are the most economical in both cases, and that type F with concrete steel reinforcement is the cheapest of any

Approximate Cost of Steel Re-Inforcement.

	Cost per foot of double track—					
	Floor.	Re-inforcement.	Track and floor work.	Engineering and contingencies.	Total.	Total cost of additions to structure.
Type B	$53.30	$33.00	$1.20	$8.75	$96.25	$962,500
" D	11.00	33.00	1.20	4.50	49.70	497,000
" E	8.00	33.00	1.20	4.22	46.42	464,200
" F	6.25	22.15	1.20	2.96	32.56	325,600

Approximate Cost of Concrete Steel Re-Inforcement.

	Cost per foot of double track—					
	Floor.	Re-inforcement.	Track and floor work.	Engineering and contingencies.	Total.	Total cost of additions to structure.
Type B	$53.30	$17.30	$1.20	$7.18	$79.00	$790,000
" D	11.00	17.30	1.20	2.95	32.45	324,500
" E	8.00	17.30	1.20	2.65	29.15	291,500
" F	6.25	17.30	1.20	2.47	27.22	272,200

In computing these costs, concrete in floor types E and F was taken at $8.00 and $10.00 per cu. yd., respectively, in place; concrete in concrete-steel re-inforcement at $10.00 per cu. yd. in bulk, and $15.00 per cu. yd. in forms, both in place. Steel in steel re-inforcement was taken at $65.00 per ton erected and in concrete-steel re-inforcement at $45.00 per ton erected. Creosoted lumber was taken at $60.00 per M. in place, ballast at $2.00 per cu. yd. in place, rivets cut out at 20 cts. each, holes drilled at 40 cts. each, and rivets driven at 45 cts. each. All prices include contractors' profit. Engineering and contingencies were figured at 10 per cent. Cost of track not included in above figures. If concrete track enclosures as shown in Figs. 11, 12, 18 and 19 are used add $90,000 to the totals of Types E and F in steel re-inforcement and $80,000 to Types E and F in the concrete-steel re-inforcement.

of the types shown. If, instead of broken stone ballast, a granulated slag ballast is used, a slight reduction in the cost can be realized. Should a slag ballast weighing 35 lbs. per cu. ft. be heavy enough to hold the track, and if an overstress of 10 per cent. in the stringers is allowable, the cross girders only would have to be reinforced in type F. For the loads the loop carries, and at the speeds permitted, it is probable that slag ballast would answer. Stretching a point, then, as to the overstress in the stringers and columns, type F, with steel reinforcement, would require strengthening of the cross girders only, and could, therefore, be applied complete for about $12.50 per lineal foot, or $125,000 for the total structure.

A secondary result of the ballasted floor is the raising of the base of the rail, the minimum increase being 10½ in. in the case of type F, and the maximum 13 in. in the case of type B. In type E the increase is 12 in. This would necessitate raising the station platforms a corresponding amount, which would involve an additional total expense of about $5,000 in both cases for the entire loop.

In order to put in the new floor and the reinforcement it would be necessary to block up either one or both of the tracks. To do this, traffic would have to be suspended. By doing this part of the work at night, the in- that period, since the new floor could be put terference with traffic would be limited to in place after the track had been raised, without stopping traffic during the day. It is important, however, that sufficient opportunity be given to work effectively in putting in the reinforcement, and in the case of the concrete-steel reinforcement the live load should be kept off until the concrete had set, which means a minimum of 14 days and a maximum of 30 days. For this purpose it would be necessary to restrict all trains to one track between stations, taking each track in turn. This would congest traffic, especially during the rush hours, and relief would have to be sought in secondary terminals or other means. It is not impractical to build one or two temporary tracks adjoining the present structure, between stations. This would take the traffic off the structure altogether and would greatly facilitate its reconstruction in case it should be found desirable to adopt this method of sound deadening.

Defects in Structure.

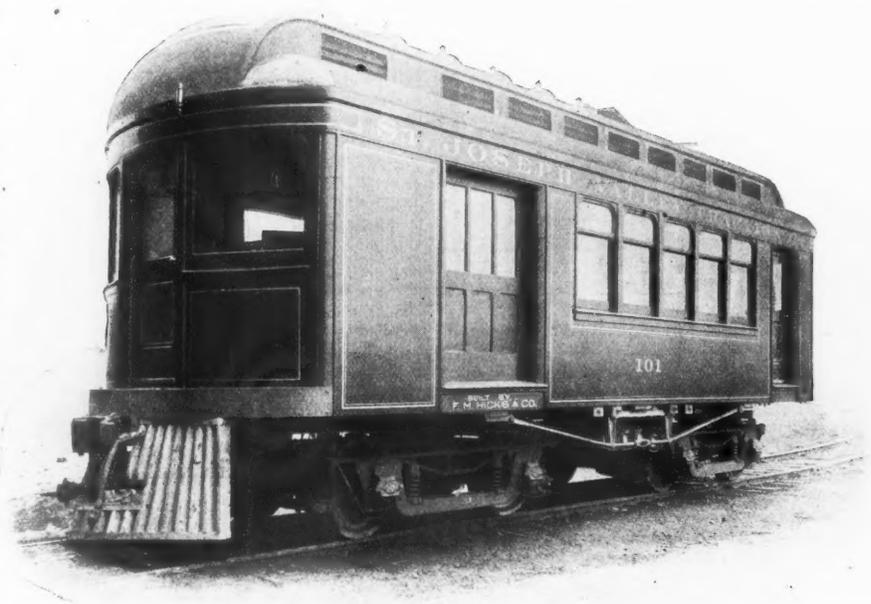
The present supporting structure of the Union Loop is constructed entirely of steel, which is set in elastic vibration by the passing loads. The various component parts of the structure enclose air spaces more or less confined, which are in turn set in vibration by the molecular motion of the adjacent steel, while the structure as a whole is free to vibrate under influence of the live loads. It is apparent, therefore, that the loop as built realizes every essential condition for the production of noise.

The concrete-steel reinforcement does the exact opposite. As a sounding medium it is very low, having about one-tenth the sound wave velocity of steel. In encasing the steel it places an inelastic medium between it and the confined air spaces and thus destroys their resonance. It also largely increases the rigidity of the structure and the bulk of material in it, thus destroying all noise due to vibration. For these reasons, the concrete-steel reinforcement should completely eliminate the noise created by the structure itself, leaving only such noises as are inherent in the trains themselves.

Gasolene Electric Motor Car for the St. Joseph Valley Traction Company.

The accompanying engravings show a gasolene electric motor car recently completed for the St. Joseph Valley Traction Co., St. Joseph, Mich. In designing the framing the endeavor was to combine simplicity and strength, in order to have as few parts as possible and provide for concentrated loads upon the floor. The center sills are formed of two 6-in., 14¾-lb. I-beams and the side sills of 5-in. x 8-in. yellow pine. There are four 4-in. x 6½-in. yellow pine intermediate sills, or eight longitudinal sills in all. The end sills are 8-in. x 12-in. oak, the transoms are formed of two 1½-in. x 10-in. wrought-iron plates, and the numerous floor joists are 2¼ in. x 4½ in. The underframe is tied with transverse ⅝-in. wrought-iron rods. The floor is formed of two thicknesses of ¾-in. pine separated by a layer of Neponset paper. The side framing is extra heavy and reinforced by continuous blocking. The underframing is designed to carry its load with a large factor of safety, but additional provisions have been made to transmit stresses, due to excessive bending movements upon the under-framing, to heavy wrought-iron car lines which serve as trusses across the deck of the car. The body is trussed by two 1½-in. rods with 1¾-in. ends.

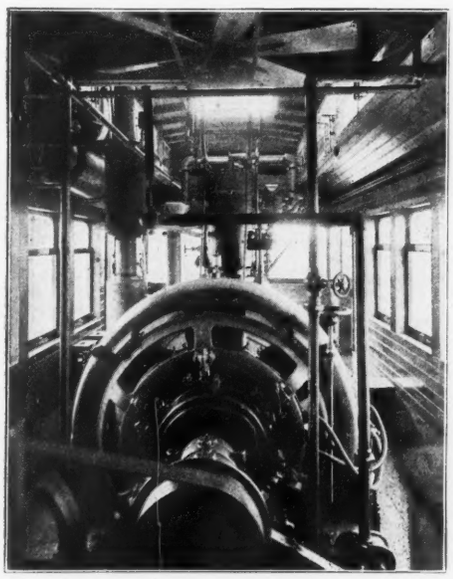
The car is divided into engine room and a baggage room, is 34 ft. long over end sills, and 9 ft. 8 in. wide over side sills. It is finished in Pullman standard color with gold striping and lettering. The heaviest design of street railway trucks with 33-in. wheels is used. The motive power is derived from a four-cylinder gasolene engine of the marine type, built by the Marinette Gas Engine Company. Under factory tests it developed 70 h.p. at 325 r.p.m., with a consumption of one pint of gasolene per h.p. hour. The cylinder jacket water is circulated by a rotary pump, bolted to a pulley on the engine shaft. The jacket water is cooled by circulation through 800 ft. of ¾-in. automobile radiator pipe, and thence through a supply tank of 190 gals. capacity. Radiation is assisted by two 42-in. fans revolving in a horizontal plane, at the rate of 300 r.p.m., directly



Gasolene Motor Car—St. Joseph Valley Traction Company.

under the radiator and exhausting the air through ventilators in the upper deck.

The engine is direct-connected to a Sprague 50-k.w., 250-volt, direct-current generator which supplies current to four 35 h.p. motors, mounted upon the trucks. To provide for the heavy load which is thrown upon the generator, for an instant, due to accelerating the car in starting, there is a battery of 120 chloride accumulators. The normal rating of each cell is 2.08 volts and the



Interior View—St. Joseph Valley Motor Car.

120 cells connected in series give a voltage of 249.6 at the terminals of the battery. The cells are placed in well ventilated lockers painted internally with asphaltum paint. The gases arising from the battery are drawn from the lockers and exhausted through the ventilators by the fans.

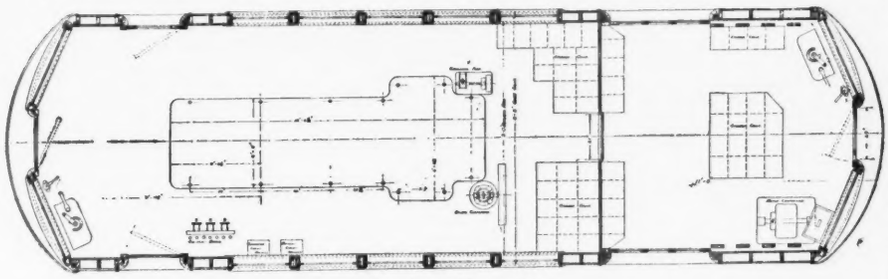
The leads from the battery are carried to the switchboard, which is of special design, and there in multiple with the generator leads are connected with the main controller leads. Therefore when a heavy pull comes upon the generator and its voltage drops below that of the battery, the load is divided between them, and vice versa. When the load does not require the total output of the generator, the excess current is used to charge the battery. Circuit breakers capable of adjustment for a series of amperages, are connected in the battery and generator leads to the switch board to obviate the necessity of replacing blown out fuses.

In addition to the traction load, the generator supplies current for a 4 h.p. motor-compressor connected with the air-brake system, current for lighting purposes, and for a small storage battery used in the gas engine ignition. The car is equipped with the National Electric automatic air-brake system, and also a hand-brake rigging. In the upper deck, directly above the engine cylinders, are two heavy hinged trap-doors through which the cylinder heads and pistons may be readily removed. This trap-door may also be used in fair weather as a means of ventilating the car. The gasoline supply is carried underneath the car in a heavy galvanized iron tank of 125 gals. capacity. The supply of gasoline to the engine is fed by a small reciprocating pump. The supply is always greater than that required by the engine, and the excess gravitates back to the reservoir through an over-flow pipe.

Two methods for starting the engine have been provided, either of which may be used independently of the other. The first method, and the one which will probably be most used, is that of driving the generator as a motor from the storage battery until the gasoline is working normally through the engine. To do this the field leads from the generator, instead of being run directly to the field rheostat, are led through an intermediate switch upon the board. By throwing this switch, the field of the generator may be connected with the storage battery and fully excited. Then by means of a single pole, four-point switch, connected with a series of resistances, current may be gradually fed to the armature, when the generator will start as a motor. As soon as the engine takes hold of the load it is only necessary to throw the field current back under the control of the rheostat.

By the second method the engine pistons are driven by compressed air until gasolene works normally through the engine. For this purpose an air compressor is belted to a pulley on the engine shaft. This compressor has a capacity of 5.9 cu. ft. of free air per minute, running at 165 r.p.m., and maintains a pressure of 200 lbs. per sq. in. in two cylindrical steel reservoirs. These reservoirs are also connected with the reservoirs of the air-brake system (where a pressure of 90 lbs. per sq. in. is maintained) through a reducing valve so that in case the motor-compressor should become disabled, the air-brake system could be operated.

The mechanical and electrical equipment of the car occupies 33 per cent. of the floor space and weighs about 25 tons. The total weight of the car is about 45 tons. No efficiency test has as yet been made but a trial run through the shop yards showed that 26 miles an hour could easily be made. The car was designed and built by F. M. Hicks & Co., Chicago.



Plan of Gasolene Motor Car.

Iron and Steel Institute.

The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George street, Westminster, London, on May 11 and 12. The election of officers and council will take place at that time, and the Bessemer gold medal for 1905 will be presented to Professor J. O. Arnold (Sheffield). The awards of the Andrew Carnegie Gold Medal and Research Scholarships for 1905 will also be announced, after which the following papers will be submitted: (1.) "On Experiments on the Fusibility of Blast Furnace Slags," by O. Boudouard, D.Sc.; (2.) "On Recent Developments of the Bertrand-Thiel Process," by J. H. Darby and G. Hatton; (3.) "On the Application of Dry-air Blast to the Manufacture of Iron," by James Gayley (New York). Supplement to paper read on Oct. 26, 1904; (4.) "On the effect produced by Liquid Air Temperature on the Mechanical and Other Properties of Iron," by R. A. Hadfield (President); (5.) "On the Cleaning of Blast Furnace Gas," by Axel Sahlin; (6.) "On the failure of an Iron Plate through Fatigue," by S. A. Houghton; (7.) "On the Continuous Steel-making Process in Fixed Open-hearth Furnaces," by S. Surzycki (Czenstochowa, Poland); (8.) "On Accidents due to the Asphyxiation of Blast Furnace Workmen," by B. H. Thwaite; (9.) "On the Behavior of the Sulphur in Coke in the Blast Furnace," by Professor F. Wüst, Ph.D., and P. Wolff. The autumn meeting will be held in Sheffield, England, from Sept. 25 to 29, 1905. Bennett H. Brough, Secretary, 28 Victoria street, S. W., London.

Train Accidents in the United States in March.[1]

*bc, 1st, Louisville & Nashville, Lebanon Junction, Ky., butting collision of freight trains, wrecking both engines and several cars. The wreck took fire and was partly burnt up. Two trainmen were killed and a third was injured. It is said that the collision was due to misreading of telegraphic orders.

unx, 1st, Baltimore & Ohio, Colfax, W. Va., westbound passenger train No. 7 was derailed and five passengers were injured.

unx, 1st, Southern Railway, Rockfish, Va., the two rear cars of passenger train No. 38, running at high speed, were derailed and overturned, and four passengers were injured.

o, 1st, Baltimore & Ohio, Ellerslie, Pa., the mail car in westbound passenger train No. 9 took fire and was burnt to the trucks, together with a large quantity of mail matter, said to include 1,500 registered letters and a large amount of paper money.

*rc, 2d, Delaware, Lackawanna & Western, Le Roy, N. Y., a fast freight train ran over a misplaced switch and into the rear of a preceding freight standing on a side track, wrecking the engine and six cars. The wreck took fire and several of the cars were burnt up. One trainman jumped off and was injured.

xc, 2d, Pennsylvania road, Lilly, Pa., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking eight cars. A passenger train on another track ran into the wreck, badly damaging two engines and one sleeping car.

*†rc, 3d, 7 p.m., Pittsburg, Ft. Wayne & Chicago, Clifton, Pa. (heretofore reported as occurring at Emsworth), an eastbound passenger train which had stopped because of a hot journal was run into at the rear by a following passenger train, wrecking two cars. Seven passengers and one trainman were killed and 35 passengers were injured.

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

This collision was reported in the *Railroad Gazette* of March 10, and, as there stated, it was due to the failure of the engineman of the second train to heed block signals set against him. The distant signal, which should have warned the oncoming train and which the engineman says that he did not see, is 2,874 ft. back of the signal which indicated stop behind the standing train. Steam was not shut off on the engine of the moving train until it was within about 100 ft. of the block signal at which it should have stopped.

bc, 3d, Evansville & Terre Haute, Fort Branch, Ind., butting collision between a passenger train and a freight, in a dense fog; three passengers and one trainman injured.

bc, 4th, Seaboard Air Line, Sanderson, Fla., a passenger train ran over a misplaced switch and into the head of a freight train standing on the side track, wrecking both engines and one mail car. One mail clerk and one engineman were killed and a fireman was fatally injured.

xc, 4th, Southern Railway, Alton, Ky., a work train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking two cars; 20 employees injured.

dn, 4th, 7 p.m., Atlantic Coast Line, Kingstree, S. C., a freight train was derailed at a misplaced switch and the engine and 10 cars were wrecked. The engineman and fireman were injured.

unx, 4th, Texas & Pacific, Clarksville, Tex., an empty engine running backward was derailed and overturned. Of the three men on the engine two were killed and one was seriously injured, all being severely scalded. The survivor stated that the speed of the engine at the time of the derailment was about 16 miles an hour.

bc, 5th, Baltimore & Ohio, Defiance, Ohio, butting collision of freight trains, wrecking three locomotives and many cars. One fireman was killed and two other trainmen were injured. It is said that the collision was due to a mistake in orders.

†bc, 5th, Northern Pacific, Bearmouth, Mont., butting collision between a westbound passenger train and an eastbound freight, due to a miscalculation of time by the engineman of the freight; one passenger and one fireman killed and 20 other persons injured.

dr, 7th, Central of Georgia, Bremen, Ga., a passenger train was derailed at a switch which had become loose by the breaking of its main rod, and the baggage car and smoking car fell down a bank and were wrecked. Two passengers and three trainmen were injured.

rc, 8th, Central of Georgia, Smarrs, Ga., a passenger train ran into the rear of a preceding wrecking train, wrecking one passenger car and four freight cars and badly damaging the engine. Five trainmen were injured, one of them fatally.

xc, 8th, night, Mobile & Ohio, Tuskaloosa, Ala., collision between a freight train and a switching engine, the latter having no headlight. One fireman was killed.

rc, 9th, Pennsylvania road, Mill Creek, Pa., a freight train standing at a water tank was run into at the rear by a following freight, wrecking the engine and 12 cars. Two trainmen were injured.

unx, 9th, St. Louis, Iron Mountain & Southern, Forrest City, Ark., a freight train was derailed and the caboose was wrecked. One passenger and four trainmen were injured.

bc, 10th, Pennsylvania road, Pittsfield, Pa., butting collision between eastbound passenger train No. 6 and a westbound empty engine. Three passengers and four trainmen were injured, one of the latter fatally. The empty engine was running on the time of the passenger in consequence, it is said, of the failure of the engineman's watch, which was 10 minutes slow.

bc, 10th, Baltimore & Ohio, Mark Center, Ind., butting collision between a westbound passenger train and an eastbound freight; the passenger fireman was killed and the engineman fatally injured.

bc, 11th, Michigan Central, Cheney, Mich., butting collision of freight trains, wrecking both engines and five cars. Four trainmen were injured.

unx, 11th, Buffalo, Rochester & Pittsburg, McCalmont, Pa., a southbound passenger train was derailed on a curve and the engine and two passenger cars were wrecked. The mail car fell into a river. The engineman was killed and five passengers and three trainmen were injured.

dr, 12th, Sandersville Railroad, Tennille, Ga., a passenger train was derailed by a broken rail and a passenger car was overturned. Three passengers were injured.

unf, 12th, 3 a.m., Missouri Pacific, Levisque, Ark., a freight train was derailed and the engine and several cars fell down a bank. Three trainmen were injured, one of them fatally.

xc, 13th, Denver & Rio Grande, Fountain, Colo., collision between a southbound passenger train of the Missouri Pacific and a northbound D. & R. G. passenger train, the latter of which was entering a side track. A dining car and one sleeping car were overturned, and ten passengers and one trainman were injured, the latter fatally.

eq, 13th, Chesapeake & Ohio, Fayette, W. Va., freight train No. 95 was derailed by a broken wheel and eight cars fell down a bank. One brakeman was injured.

unx, 14th, Atlantic Coast Line, Wilmington, N. C., a switching engine was derailed and fell down a bank, and one trainman was killed. Two others were injured.

xc, 15th, Arkansas Western, Waldron, Ark., the rear portion of a mixed train standing at the station escaped control while the engine was doing some switching and ran back down grade some distance and collided with a string of freight cars, making a bad wreck. Five passengers were injured, one of them fatally.

eq, 15th, Chicago, Rock Island & Pacific, Flagler, Colo., passenger train No. 15 was derailed by the breaking of the flange of a wheel of the engine, and the smoking car was overturned. Four trainmen and three passengers were injured.

o, 15th, Pennsylvania road, Bolivar, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler. The engineman was killed, the fireman and conductor fatally injured and twelve track laborers more or less severely hurt.

bc, 16th, Toledo, St. Louis & Western, Marion, Ind., butting collision of freight trains, wrecking both engines and 18 cars. One fireman was fatally injured.

unx, 17th, Southern Railway, Ensley, Ala., a mixed train was derailed and wrecked. The engineman was killed and the fireman and one passenger were injured.

xc, 17th, a freight train of the Wheeling & Lake Erie ran into a passenger train of the Cleveland & Pittsburg at the crossing of the two roads, wrecking the express car; five trainmen injured.

dr, 18th, Atchison, Topeka & Santa Fe, Hutchinson, Kan., a westbound passenger train was derailed by a broken rail; ten passengers injured.

unf, 18th, Louisville & Nashville, Berea, Ky., a freight train was derailed by a rock which had fallen from the roof of a tunnel and lodged on the track, and the engine was overturned. The fireman was severely injured.

dr, 19th, Yazoo & Mississippi Valley, Connorsburg, Miss., a passenger train was derailed by a broken rail and one passenger was fatally injured.

eq, 19th, Erie road, Winfield, Ind., westbound passenger train No. 9, second section, was derailed, while running at high speed, by an air reservoir which dropped from its place beneath the cab of the engine and knocked the front truck of the tender off the track. Most of the train fell down a bank. Of the 27 passengers in the two passenger cars of the train, 12 were injured, two probably fatally.

xc, 20th, Beatrice, Neb., passenger train No. 18 of the Chicago, Burlington & Quincy collided with a freight train of the Chicago, Rock Island & Pacific at the crossing of the two roads, wrecking both engines. The engineman and fireman of the freight train were severely injured.

dn, 20th, Chicago, Rock Island & Pacific, Potter, Ind. T., a freight train was derailed at a misplaced switch and the engine and two cars of cattle were overturned. The engineman was killed and the fireman and one brakeman were ...

rc, 21st, 4 a.m., Atlanta, Knoxville & Northern, Temico Junction, Tenn., a freight train which had been unexpectedly stopped was run into at the rear by a following freight, making a bad wreck. Two men were killed and two injured.

unf, 21st, Chicago, Rock Island & Pacific, Homestead, Iowa, a passenger train was derailed at a point where the track had been maliciously loosened, and the engine and first four cars fell down a bank. The engineman was severely scalded and five other persons injured.

o, 21st, Illinois Central, Kenner, La., a car in a freight train was blown up by the explosion of some packages of dynamite which were among its contents; 17 cars were wrecked and two men were killed.

unx, 22d, Yazoo & Mississippi Valley, Fayette, Miss., freight train No. 592 was derailed and eight cars were wrecked. Two trainmen were injured.

xc, 23d, Cleveland, Cincinnati, Chicago & St. Louis, Norwood, Ind., collision of locomotives in the new yard; five employees injured.

unx, 23d, Chicago, Burlington & Quincy, West Lincoln, Neb., a passenger train was derailed and two passenger cars were overturned; 31 persons were injured.

unf, 24th, St. Louis & San Francisco, Arthur, Tex., a passenger train was derailed at a bridge which had been weakened by fire, and three cars were ditched. Several passengers were injured, one of them fatally.

unx, 25th, Grand Rapids & Indiana, Fort Wayne, Ind., passenger train No. 8 was derailed and the engine was overturned. The fireman was severely injured.

dr, 25th, Southern Railway, Corryton, Tenn., freight train No. 81 was derailed by defective track and the engine and several cars were overturned. One trainman was killed and two were injured.

rc, 26th, Baltimore & Ohio, Stanton, Del., a freight train standing at a water tank was run into at the rear by a following freight, wrecking the engine and several cars. One fireman and one brakeman were fatally scalded and one engineman was injured.

xc, 26th, Louisville & Nashville, Clarksville, Tenn., a freight train ran into a string of freight cars which, escaping control on a side track, had run to the main track, and the engine and 20 cars were wrecked. Two trainmen and two men stealing a ride were killed.

unx, 27th, Southern Railway, Andrews, N. C., a passenger train was derailed and six persons were injured.

xc, 28th, Atlantic & Birmingham, Fitzgerald, Ga., a passenger train ran over a misplaced switch and collided with three engines standing on a side track, and the passenger engine was overturned. Two trainmen and several passengers were injured.

unx, 29th, Rutland road, North Petersburg, N. Y., a mixed train was derailed and the three rear cars fell down a bank. All of the passengers were thrown into a river, and three of them were seriously injured.

dr, 29th, Pittsburg, Fort Wayne & Chicago, Alliance, Ohio, a freight train was derailed at a point where the track had been distorted by the heat of the sun. The fireman was killed and one brakeman was injured.

unx, 29th, Chicago, St. Paul, Minneapolis & Omaha, Mankato, Minn., a freight train was derailed and the engine fell down a bank. The engineman was killed.

unx, 29th, Pennsylvania road, Tyrone, Pa., a passenger train was derailed and fell down a bank; six passengers were injured.

rc, 30th, 4 a.m., New York, New Haven & Hartford, North Kent, Conn., a freight train which had been unexpectedly stopped was run into at the rear by a following freight, and eight cars were wrecked. The engineman of the foremost train was under his engine at the time and was badly injured.

unf, 30th, Great Northern, Basin, Mont., a passenger train was derailed by a rock which had fallen from the mountain side and lodged on the track. The engineman was killed and the fireman injured.

GENERAL NEWS SECTION

NOTES.

The Lower House of the Wisconsin Legislature has passed, by a vote of 75 to 12, the Governor's bill to regulate railroad rates.

The railroads west of Chicago have announced that after July 1 the minimum carload weight for grain will be raised from 12 tons to 15 tons.

The Pittsburg & Lake Erie has given notice that it will refuse to receive from connections any cars which do not pass inspection under the federal safety appliance laws.

The Mexican Government has announced that the act for the reformation of the currency (the establishment of the gold standard) shall go into effect on May 1. The free coinage of silver was stopped on April 15.

The freight department of the Pennsylvania Railroad has issued a book showing the principal industrial facts concerning all of the towns and cities on its lines east of Pittsburg and Erie; and another one containing a list of available properties and sites for manufacturers.

The steamers of the Hudson River Day Line will after May 14 land in New York at the new pier at West 42d street instead of at the pier at West 22d street, which has been discontinued. On the same date the steamers of the Sandy Hook route of the Central Railroad of New Jersey will also use the same new pier.

The General Assembly of North Carolina has enacted that any person who wilfully and maliciously removes the waste or packing from the journal box of a locomotive or of a car, on either a steam or electric railroad, shall be liable to fine or imprisonment in jail or state's prison, according to the discretion of the court.

The Railroad Commissioners of Georgia have issued a new storage rule which requires railroads to notify the consignor when a consignment of freight is refused by the consignee; and, if the consignor does not, within three days, give directions for the disposition of the goods, he will become liable for the storage charges. The rule apparently applies only to carload lots, except where the packages show the name and address of the sender.

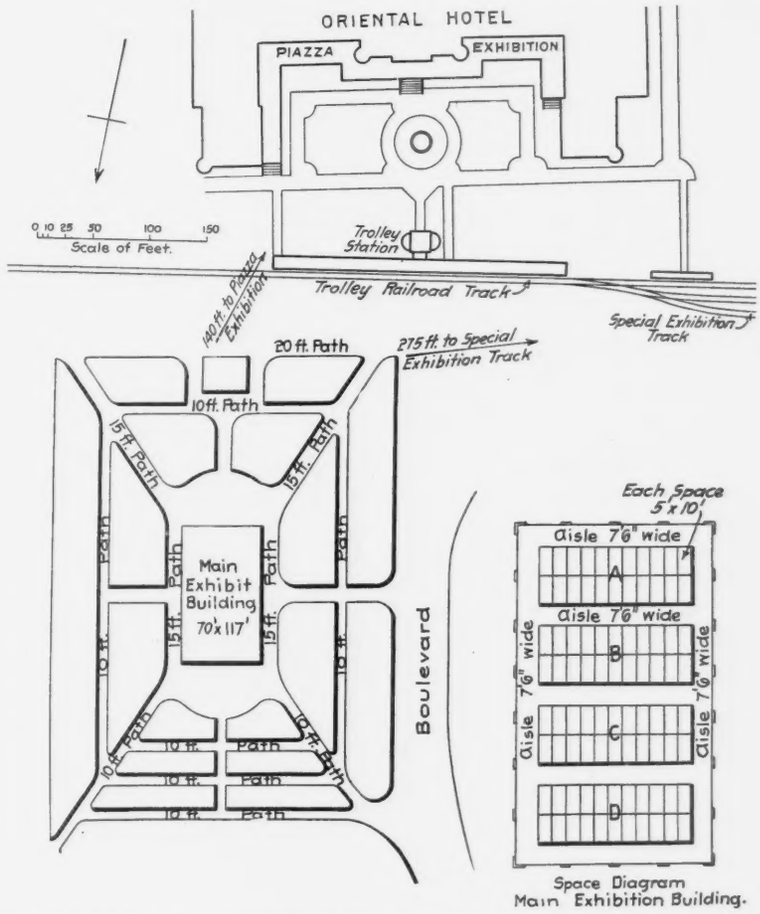
Pennsylvania papers report that on the Philadelphia division of the Pennsylvania Railroad the payment of premiums to firemen for economizing in the use of coal has been discontinued. Some of the firemen had been making as much as $15 a month in premiums; but it appears that some of them, in their zeal to save, failed to keep the steam up to the proper pressure. The firemen's records will be watched, as heretofore, and will have an important influence, when the proper time comes, in deciding the fireman's eligibility for promotion.

Canadian Railroad Subsidies.

Statistics presented to the Canadian House of Commons show that since July 1, 1873, the following sums have been expended by the government on railroads and canals: Constructing and equipping railroads, $88,310,791; subsidizing railroads, $59,287,995; constructing and equipping canals, $66,966,699. In addition the following grants of land have been made as subsidies to railroads: Ontario, 4,551,747 acres: Manitoba, 9,124,524 acres; Northwest Territories, 13,970,076 acres, and British Columbia, 2,923,007 acres; a total of 30,569,354.

Exhibits at the June Conventions.

The accompanying drawing shows a plan of the exhibition grounds for the display of exhibits in connection with the annual conventions of the American Railway Master Mechanics' and the Master Car Builders' Associations to be held at Manhattan Beach, N. Y., June 14 to 21. The grounds will be 300 ft. x 450 ft., and in the center of this space will be the main exhibition building, 70 ft. x 117 ft., which will be under cover and will contain 88 spaces each 5 ft. x 10 ft. Space will also be reserved on the north piazza of the Oriental Hotel. A special exhibition track for the display of cars, locomotives, trucks, etc., will be built 275 ft. west of the main grounds parallel to the electric railroad tracks which pass in front of the hotel. Applications for space should be made to Mr. J. Alexander Brown, 24 Park Place, New York.



Plan of Exhibition Grounds at Manhattan Beach, M. C. B. and M. M. Association Conventions.

The Traffic Manager.

In reply to a question by Senator Elkins as to whether or not illegal discriminations and rebates would cease if traffic managers were compelled to make reports under oath once in three months Mr. Morawetz answered: "I do not think so. The traffic managers would perjure themselves, and those who would not do that would not take the office."

The foregoing is from the New York *Herald's* report of the first hearing held by the Senate Committee on Interstate Commerce, at Washington April 18. Mr. Morawetz is Chairman of the Executive Committee of the Atchison, Topeka & Santa Fe.

Railway Appliance Exhibition.

J. Alexander Brown, Secretary and Director of Exhibits of the American Railway Appliance Exhibition, New Willard Hotel, Washington, D. C., sends the names of the following additional firms which have become members since the list was last printed in the *Railroad Gazette*:

Ajax Metal Co., Philadelphia, Pa.
American Iron & Steel Co., Lebanon, Pa.
American Water Softener Co., Philadelphia, Pa.
Aurora Automatic Machinery Co., Aurora, Ill.
Pullard Machine Tool Co., Bridgeport, Conn.
Burnham, Williams & Co., Philadelphia, Pa.
Consolidated Cross-Tie Company, New York, N. Y.
Crago & Behrnstadt, Cadett, Wis.
Edison Mfg. Co., New York, N. Y.
Elliott Fisher Co., Philadelphia, Pa.
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
Odenkirk Switch & Signal Co., Cleveland, Ohio.
Protectus Company, Philadelphia, Pa.
Rendle, Arthur E., New York, N. Y.
St. Louis Car Wheel Co., St. Louis, Mo.
Singer, M. A., New York, N. Y.
Western Steel Car & Foundry Co., Chicago, Ill.
White Enamel Refrigerator Co., St. Paul, Minn.

Schilhan's Safety Switch.

The accompanying illustrations show the general arrangement and details of a novel safety switch designed by Janos Schilhan, Budapest. The switch is in use on several Hungarian roads. The object of this apparatus is to prevent the tongue of the switch from being thrown over during the passage of a train, and to prevent a derailment if the switch is left in a midway position.

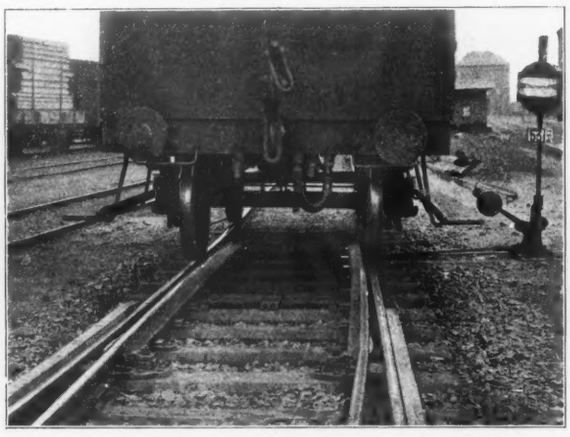
The locking of the switch during the passage of a train is effected by means of the treadles 6 and 7 placed on the outside of each track. The treadle on the track for which the switch is set is depressed to the level of the rail, while the other treadle stands above the rail. A train on the proper track holds down the treadle and locks the tongue in position by the wedges 15 and 16. If a train approaches the switch from the wrong track it depresses the raised treadle, which throws the switch by means of the wedges 15 and 16 and also by means of the cross lever 10 and the links 11 and 12 raise the other treadle.

The prevention of derailment when the switch is left half open can be obtained in three ways. The first method is illustrated in Figs. 3 and 4. The head and web of tongue 2, Fig. 1, are cut away and replaced by a separate piece 17, Figs. 3 and 4; held in position by a bolt 18, forming a pivot, and a weaker bolt 19, which holds the inset under normal conditions. If a pair of wheels in passing over the switch misses both points, the right wheel flange will press against the tongue 2 at about the point 5, break the bolt 19, swing over the piece 17 and pass to the inside of the rail.

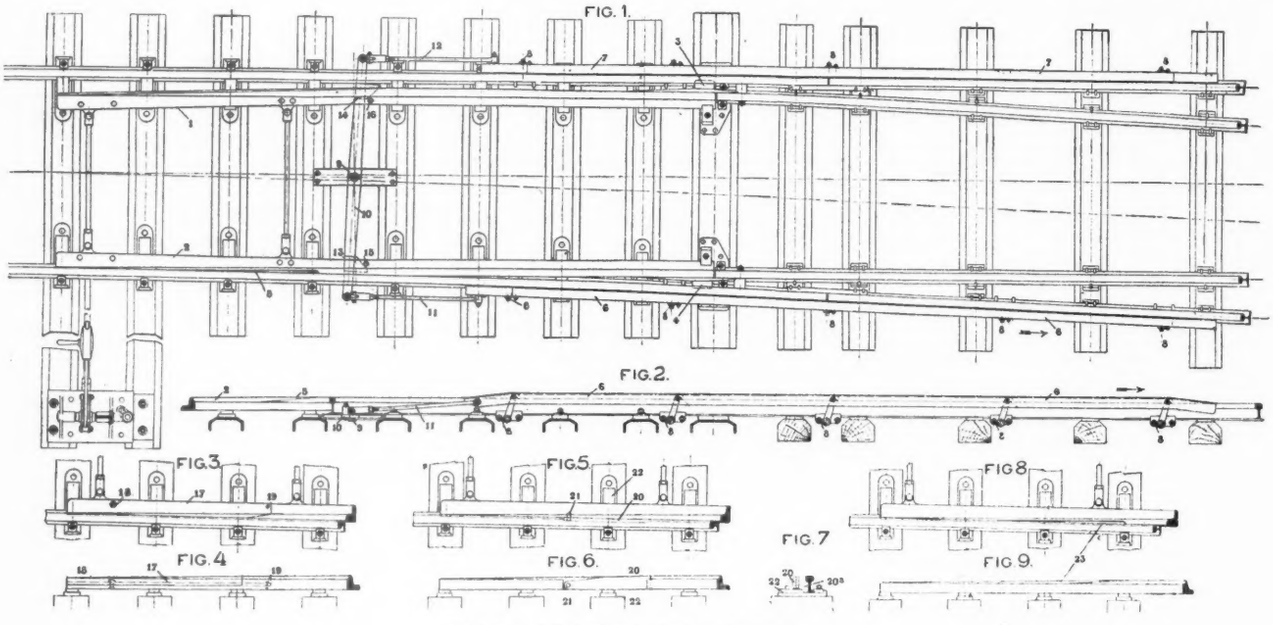
In the second design the tongue retains its normal shape, and the arrangement shown in Figs. 5, 6 and 7 is used. At the point 5 on the tongue 2, Fig. 1, where the distance between the outside edges of the points is equal to the distance between the inside faces of the wheel flanges, a wedge 20 is pivoted by the bolt 21. When the switch is closed the wedge 20 is carried by the chair 22, but when opened the wedge drops of its own weight and a flange coming outside the tongue 2 is carried up the wedge over the tongue to the proper inside position.

In the third design a wedge shaped groove is cut on the outside of the tongue 2 so that the wheel flange runs up this groove and over the tongue. This groove is shown at 5 on Fig. 1 and 23 in Figs. 8 and 9. The American rights of this switch are represented by G. Leve, 114 Liberty street, New York.

Schilhan's Safety Switch Set for Siding.



Car Passing Through Switch on Main Track.



Details of Schilhan's Safety Switch.

A New Plan to Enable Conductors to Distinguish Fraudulent Railroad Tickets.

Instead of the ordinary bulletin which the railroads usually issue regarding counterfeit tickets, Passenger Traffic Manager D. G. Edwards, of the C., H. & D. and C., C. & L. roads, has adopted a new plan, which is undoubtedly much more helpful to conductors in enabling them to distinguish the spurious tickets. The new scheme consists in photographing the two tickets and reproducing them, as nearly as possible in the correct colors, in the circular. The main points of difference between the genuine and fraudulent ticket are enumerated, the particular ticket to which the circular relates purporting to have been issued by the C., H. & D., good via the Rock Island, Burlington and Northern Pacific roads, and showing a Northern Pacific coupon from Billings, Mont., to Portland, Ore. The circular is of a size and shape to enable it to be folded once and carried in the conductor's pocket-book. There have been many requests for these circulars from connecting lines.

Interurban Service on the Alton.

The Chicago & Alton has installed interurban service between Springfield and Girard, 25 miles, and between Bloomington and

Pontiac, 35 miles. The trains are making four round trips a day between these points as a supplement to the regular train service. At present a small engine and coach are being used, but it is the intention to build at once a gasoline-electric car for this and branch-line service. The rates of fare are the same as on the electric lines in that territory.

Manufacturing and Business.

The Bucyrus Company, South Milwaukee, Wis., is building four steam shovels for work on the Panama Canal.

The Farlow Draft Gear Co., which was organized about a year ago with a capital of $250,000, is planning to build a shop and foundry in or near Baltimore.

The general offices of the American Locomotive Company and the Atlantic Equipment Company have been removed from 25 Broad street to 111 Broadway, New York City.

Secretary Jos. W. Taylor, of the Master Car Builders' Association, Master Mechanics' Association and Western Railway Club, has moved his offices from The Rookery to 390 Old Colony Building, Chicago.

The United States Railway Supply Company, of New York City, has been incorporated with a capital of $200,000. The directors include H. V. Poor, Mountford Mills, and G. E. Hargrave, New York City.

The Robeson Process Company, of Camden, has been incorporated in New Jersey, with a capital of $25,000, to make foundry supplies, by Norman Grey, W. B. Wolcott and W. B. MacDonald, all of Camden, N. J.

The Daly Spike Co. has been organized at Detroit, Mich., with $25,000 capital, to make railroad construction materials. The incorporators include Angus Smith, of the Olds Motor Works; Harry W. Frost, of Berry Bros., and James H. Benedict.

The Ralston Car Co., Chicago, has bought the plant of the Rarig Engineering Co., Columbus, Ohio. The necessary equipment is now being placed and it is expected to be in operation within 30 days. The capacity will be 25 steel cars a day.

The Empire Engineering Incorporation of New York City has been incorporated, with a capital of $1,000,000, to do a general contracting and engineering business. The directors are E. D. Adams, L. W. Bates, W. B. Parsons, A. Skitt and W. S. Hulse, all of New York.

Aaron Dean, Jr., formerly Superintendent of Construction of the General Railway Signal Company, has been appointed Eastern Agent of the Federal Railway Signal Company, with office at 150 Nassau street. After April 30 the New York office of the company will be at 60 Wall street, New York City.

In our "car building" column, April 14, in describing the 200 semi-convertible cars ordered by the Chicago City Railway from the J. G. Brill Co., we stated that the cars would be equipped with the "Consolidated Electric Company's heating system." The heating system is that of the Consolidated Car Heating Co., of Albany, N. Y.

The Tatlow Turntable Attachment Co., Denver, Colo., reports recent shipments as follows: Eight to the St. Louis & San Francisco for East St. Louis, Monett, Mo., Newburg, Mo., Neodesha, Kan., South Springfield, Mo., Sapulpa, Ind. T., Fort Smith, Ark., and Memphis, Tenn., respectively; one to the A., T. & S. F. Ry. for Gallup, N. Mex.

The American Water Softener Co., of Philadelphia, Pa., and Columbus, Ohio, reports that installations of the Bruun-Lowener water softener have been made on railroads in the United States, Argentine Republic, Chile, Spain, Denmark, Sweden and Russia, while the installation among industrial plants covers practically every country on the globe.

The Toledo Massillon Bridge Co. is seeking incorporation in Ohio with a capital of $250,000, to take over the property of the Massillon Bridge Co., at Massillon. In addition to operating the Massillon plant it is proposed to build another in Toledo. The incorporators are: T. H. Tracey, J. J. Swogart, Clarence A. Draper, Charles S. Davis and C. A. Prentham.

Dodge & Day, engineers, Philadelphia, Pa., who have for the past three years designed the electrical equipment for operating the hoisting and conveying machinery built by the Dodge Coal Storage Co., will also have charge of similar work in connection with the telpherage apparatus that will now be manufactured by the Dodge Coal Storage Co. as a result of their acquisition of the United Telpherage Co.'s interests.

A syndicate composed of Pittsburg business men, according to reports from Pittsburg, has paid $1,500,000 for 600 acres of land near Allequippa, on the Ohio river, and will build one of the largest iron and steel works in the country at this place. In addition to steel mills, a large glass furnace and shops for making pressed steel cars are to be built. Henry Fownes is said to be the chief promoter of the scheme.

The Dayton Pneumatic Tool Co., Dayton, Ohio, has been incorporated in that state with a capital of $50,000 for the purpose of manufacturing pneumatic tools and all kinds of air appliances. This company has taken over the business of the Chicago Tool & Supply Co., and will make the "Green" pneumatic hammers in its own factory at Dayton, where the principal offices will also be located.

The Independent Railroad Supply Co., Chicago, has received two orders from the Illinois Central for Wolhaupter rail joints amounting to 50 miles. Also an order for joints from the Cleveland Electric R. R. Shipments have been made as follows: Eleven cars of Wolhaupter joints to the Great Northern; nine cars to the Chicago, Burlington & Quincy; two cars to the Twin City Rapid Transit Co., and two cars to the Southern.

The Western Steel Car & Foundry Co. is building at its Hegewisch, Ill., plant a new shop of steel construction, 100 ft. x 500 ft., which it is expected will be completed by June 1st. It will be equipped with four Shaw electric cranes and other modern machinery and will employ about 500 men in addition to the present force. This new shop will be used for building steel underframe cars, increasing the present daily capacity of the plant of 40 wooden cars by 35 steel underframe cars.

Mace Moulton, Consulting Engineer, 150 Nassau street, New York, engaged by the Central New England to examine the metal bridges on the main line and branches between Hartford, Conn., and Maybrook, N. Y., to determine their condition and strength to withstand the increase in loads and speed under the contemplated changes in, and additions to, the traffic since its lease by the New Haven road, has completed his examination. About 75 bridges were inspected, and the work of reinforcement found necessary is now being done. The new spans and reinforcing material in the first lot were furnished by Harrington, Robinson & Co., Boston, Mass.

Adreon & Company, St. Louis, have secured exclusive selling rights covering the United States railroad trade for "Anti-Selenite" boiler scale solvent. This compound is made in Monterey, Mexico. Its basis is vegetable, and it is claimed that it protects instead of injures the metal in boilers; also that it is effective in removing scale under all conditions. It has been subjected to exhaustive tests in this country by all classes of steam users, and reports on file are highly favorable to the claim made by the makers. "Anti-Selenite" received a gold medal, the highest award, at the Louisiana Purchase Exposition, against 72 competitors.

The executive offices of the American Steel Foundries, formerly at 74 Broadway, New York, have been moved to 42 Broadway, where the entire eleventh floor of this recently completed building has been leased. Simultaneously with the removal, a new system of accounting and distribution of orders, which is expected to improve the organization and simplify the work, has been inaugurated to assist in taking care of the large orders resulting from the increased demand for new equipment by the railroads and other large producers. The eight plants of this concern, including the recently acquired Simplex Railway Appliance Co., has an enormous output in all kinds of steel castings.

Iron and Steel.

The Executive Committee of the Panama Railroad at its recent meeting gave an order for 3,500 tons of rails. Additional orders will soon be let.

According to reports various railroads now want 55,000 tons of rails, and orders are so largely in excess of the capacity of the mills that the United States Steel Corporation is said to be trying to buy 50,000 tons of finished material in foreign markets.

The Canadian Department of Railways has given a contract to the Sault Ste. Marie steel works for 10,000 tons of rails for the Intercolonial Railway to be delivered in July. The Sydney (N. S.) rail mills are not yet completed and will not be in operation before June.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Southern and Southwestern Railway Club.

At the meeting of this club in Atlanta, Ga., April 20, a paper on "Operation and Maintenance of Electric Light and Power Apparatus," by A. Balsley, was read.

American Society of Civil Engineers.

At the meeting of this society April 19, a paper on "The Reconstruction of the Baltimore & Ohio Railroad Bridge Over the Ohio River at Benwood, West Virginia," by J. E. Greiner, was presented for discussion. This paper was printed in the March "Proceedings."

Railway Telegraph Superintendents.

The twenty-fourth annual meeting of the Association of Railway Telegraph Superintendents will be held at the Reed House, Chattanooga, Tenn., May 17 and 18. Hotel rates are from $1.00 to $3.50 a day, and suitable rooms are provided for exhibits without charge. Arrangements have been made for a trip up Lookout Mountain May 17, and for another trip to the new Army Post on the battlefield of Chickamauga for those who can remain over Friday, May 19. H. C. Hope, of the Chicago, St. Paul, Minneapolis & Omaha, St. Paul, is President, and P. W.

Drew, Superintendent of Telegraph, Wisconsin Central Railway, Milwaukee, is Secretary.

New York Railroad Club.

At the next regular meeting of this club to be held at Carnegie Hall April 21, subjects scheduled for the annual conventions in June of the M. C. B. and M. M. Associations will be considered, in the following order, the discussions to be opened by the gentlemen named. "Repairs of Steel Cars," R. F. McKenna (D., L. & W.); "Locomotive Front Ends," H. H. Vaughan (Canadian Pacific); "Revision of Rules for Loading Long Materials," A. Kearney (Baltimore & Ohio); "Water Softening for Locomotive Use," L. H. Turner (P. & L. E.); "Safety Appliances," A. E. Mitchell (L. V.); "Tank Cars," C. M. Bioxham (Union Tank Line); "Proper Loading for Locomotives" (to be announced); "Motive Power Terminals" (to be announced); "Service of Locomotives" (to be announced).

Master Boiler Makers' Association.

The fourth annual convention of this Association will be held at Hotel Brœzel, Buffalo, N. Y., May 16, 17 and 18. The subjects to be discussed are:

1. Cause of back end flue sheets cracking; why do we have more trouble with radial boilers leaking than with other boilers?
2. Best method of removing scale from radial stays and crown bar boilers.
3. Best way of testing flexible staybolts.
4. Maintenance of flues.
5. Handling engines at ash pits and on line of road; operation of dampers.
6. Best method of preventing side sheets from corroding at mud rings.
7. Repairing boilers that have seen 25 years' service.
8. Best method of putting in radial staybolts and button head bolts.
9. Which is most advisable, one or more than one door in wide fire-boxes?
10. Best method of repairing leaking seams in fire-boxes; effects of treated water.
11. Progressive tools for boiler shop work.
12. Proper method of building boilers and applying fire-boxes.
13. To communicate with locomotive builders relative to furnishing and developing prints.

PERSONAL.

—Mr. Henry Pierce, who has been appointed Engineer of Construction of the Chesapeake & Ohio, was born June 7, 1859, at Quaker Hill, N. Y. He spent two years at Swarthmore College and three years at Cornell University, graduating from Cornell in the Civil Engineering course in 1880. On his graduation he entered the employ of the Groton Bridge Company as draftsman, and at the end of six months began his railroad experience as levelman and draftsman on the Cincinnati & South Eastern Railway. In 1883 and '84 he was draftsman on the Cincinnati, New Orleans & Texas Pacific, and from there went to the Cincinnati, Hamilton & Dayton, where he was successively draftsman, supervisor and Engineer of Maintenance of Way. He has been with the Chesapeake & Ohio since 1889, being Division Engineer of Maintenance of Way of various divisions up to March, 1902, when he was made Superintendent of the Greenbrier Division, from which place he has been promoted to be Engineer of Construction.

—Mr. E. N. Layfield, who has recently been appointed Chief Engineer of the Chicago Terminal Transfer Railroad, in charge of both maintenance and construction, is 33 years old and a native of Wilmington, Del. He was educated at the Wilmington public schools and at Delaware College. From 1892 to 1899 he was engaged in miscellaneous maintenance of way work and in charge of construction work on the Pennsylvania lines between Philadelphia and Washington. In 1899 he entered the service of the Chicago Terminal

Transfer Railroad as Assistant Engineer. He was made Principal Assistant Engineer a year later, and now is Chief Engineer.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe (Coast Lines).—Edward Chambers has been appointed Assistant Freight Traffic Manager, with office at San Francisco. W. G. Barnwell, Assistant General Freight Agent, will succeed Mr. Chambers as General Freight Agent, with headquarters at Los Angeles, Cal. H. P. Anewalt, General Freight Agent of the Santa Fe, Prescott & Phœnix, has been promoted to the position of General Freight Agent, with headquarters at San Francisco. R. W. Hobart has been appointed General Agent, with office at Fresno, Cal.

Bessemer & Lake Erie.—L. C. Bihler has been elected a Director, succeeding Geo. E. McCague, retired.

Buffalo & Susquehanna.—H. H. Gardner, who has been General Freight and Passenger Agent, has resigned to become Vice-President of the Bush Terminal Company of New York.

Chesapeake & Ohio.—The jurisdiction of E W. Grice, Superintendent of the Huntington Division, has been extended over the Greenbrier Division on account of the promotion of H. Pierce to be Engineer of Construction. J. W. Haynes has been appointed Assistant Superintendent of the Greenbrier Division, with headquarters at Ronceverte, W. Va. The office of Assistant Superintendent of the Kentucky Division, hitherto held by Mr. Haynes, has been abolished.

Chicago & Northwestern.—Wm. S. Kies, who has been City Trial Attorney of the city of Chicago, has been appointed General Attorney for the Chicago & Northwestern, with headquarters at Chicago.

Chicago, Burlington & Quincy.—H. G. Metzler, Superintendent of the Chicago Division, has resigned to become President of the Metropolitan West Side Elevated of Chicago.

Chicago Great Western.—E. C. Macy, Principal Assistant Engineer, has resigned. A. E. Harvey, Division Engineer of the Fort Dodge Division, has been promoted to Mr. Macy's position.

Chicago, Peoria & Western.—E. D. Dore, Vice-President and Auditor, has been made President and General Manager. A. E. George has been appointed Secretary and Treasurer, and J. P. Gardiner General Freight Agent, both succeeding J. J. Lamkey. F. S. Ryan has been appointed Car Service Agent. All have been appointed to similar positions on the Illinois Valley Belt.

Cincinnati, Hamilton & Dayton-Pere Marquette System.—H. C. Mann has been appointed General Advertising Manager, with headquarters at Cincinnati.

Delaware & Eastern.—Otto F. Wagenhorst has been appointed Chief Engineer of this projected road in New York State.

Erie.—Charles Hall has been appointed Traveling Coal Inspector.

Houston & Texas Central.—Henry White has been appointed Assistant Superintendent of Terminals of this company and of the Houston East & West Texas at Houston, Texas.

Houston East & West Texas.—See Houston & Texas Central.

Huntingdon & Broad Top.—Samuel Bancroft, Jr., hitherto Vice-President, has been elected President, succeeding George H. Colket, deceased. C. M. Gage, General Manager, has been elected a Director and Vice-President. He will continue as General Manager.

Illinois Southern.—G. A. Gallagher has been appointed Master Mechanic, with headquarters at Sparta, Ill., succeeding R. J. Farrell, resigned.

Illinois Valley Belt.—See Chicago, Peoria & Western.

Lake Shore & Michigan Southern.—S. W. Brown, Assistant Superintendent, has been appointed Superintendent at Chicago, succeeding H. A. Worcester. See Michigan Central.

Lehigh Valley.—F. E. Hammann, who has been Chief Clerk of the Passenger Department, has been appointed Assistant General Passenger Agent, with headquarters at New York.

Louisville & Atlantic.—The headquarters of J. R. Pates, Superintendent, and N. H. Goucher, Chief Despatcher, have been moved from Versailles, Ky., to Richmond, Ky.

Michigan Central.—H. A. Worcester, who was recently transferred from Buffalo to Chicago as Superintendent of the Lake Shore & Michigan Southern, has been appointed Assistant General Superintendent of the Michigan Central, with headquarters at Detroit.

National of Mexico.—J. H. Metcalf, First Vice-President, and J. C. MacKie, Second Vice-President, have retired and the two offices have been consolidated into the office of Vice-President, to which D. P. Bennett, hitherto Assistant to the President, has been elected. John H. Guess, Assistant Purchasing Agent, has been appointed Assistant Treasurer. Amilio Velasco has been appointed General Counsel.

New York Central & Hudson River.—The title of C. Herbert Ewings, formerly Car Accountant, has been changed to Superintendent of Freight Transportation.

New York, Chicago & St. Louis.—John J. Kearney has been appointed Freight Claim Agent at Cleveland.

New York, New Haven & Hartford.—W. S. Murray has been appointed Electrical Engineer, with headquarters at New Haven.

New York, Ontario & Western.—M. J. Edwards has been appointed Car Accountant, succeeding W. D. McQueen, promoted.

Panama.—Secretary W. A. Taft, voting the stock owned by the United States Government, has elected the following directors: Theodore P. Shonts, John F. Wallace, Charles E. Magoon, Mordecai T. Endicott, Peter C. Hains, D. M. Harrod, Oswald N. Ernst, William Nelson Cromwell, William Barclay Parsons, Clarence R. Edwards, J. R. de Obaldia, Roger L. Farnham and Edward A. Drake. Of these, Messrs. Drake, Cromwell, Parsons and Harrod were members of the former board. The directors elected the following officers: President, Theodore P. Shonts; Vice-President and General Manager, John F. Wallace; Secretary and Treasurer, E. A. Drake; Assistant Treasurer, Sylvester Deming; Assistant Secretary, T. H. Rossbottom; General Counsel, Sullivan & Cromwell; Traffic Manager, R. L. Walker; Auditor, John Adams;

Superintendent on the Isthmus, H. G. Prescott; Executive Committee, Messrs. Shonts, Wallace, Magoon, Cromwell and Edwards.

Pennsylvania Lines West (Northwest System).—F. J. Kron, Trainmaster of the Erie and Ashtabula Division, has been appointed Superintendent of the Marietta Division, with headquarters at Cambridge, Ohio, succeeding J. W. Coneys, transferred to the Logansport Division of the Southwest System. W. M. Wardrop, Trainmaster at New Castle, Pa., succeeds Mr. Kron.

Queen & Crescent Route.—Walter Harvey has been appointed Assistant Superintendent of the New Orleans & Northeastern.

San Pedro, Los Angeles & Salt Lake.—E. Hennessy has been appointed Superintendent of Dining Car Service, with office at Los Angeles, Cal.

Southern.—J. F. Sheahan, Master Mechanic at Spencer, N. C., has been transferred to Atlanta, succeeding S. M. Dolan, resigned. W. S. Murrian, Master Mechanic at Alexandria, Va., succeeds Mr. Sheahan. W. F. Kaderly has been appointed Master Mechanic of the Washington Division, succeeding Mr. Murrian.

Francis Lynde Stetson has been appointed General Counsel at New York; Alfred P. Thom, General Counsel at Washington; Col. William A. Henderson, General Solicitor at Knoxville, Tenn., and Alexander P. Humphrey, General Counsel at Louisville.

Toledo, St. Louis & Western.—J. K. Sroufe has been appointed Engineer Maintenance of Way, with headquarters at Frankfort, Ind.

Union Pacific.—A. L. Mohler, hitherto General Manager, has been elected Vice-President.

Wabash-Pittsburg Terminal.—Joseph Ramsey, Jr., President of this company, has resigned and Frederick A. Delano, formerly General Manager of the Chicago, Burlington & Quincy, has been elected his successor.

LOCOMOTIVE BUILDING.

The Atlantic Coast Line is reported to have ordered 50 locomotives from the Baldwin Works.

The Lackawanna Steel Company has ordered six locomotives from the Brooks Works of the American Locomotive Company.

The Lake Shore & Michigan Southern is reported to have ordered 25 additional locomotives from the Brooks Works of the American Locomotive Company.

The Chicago Southern has ordered 12 locomotives from the Rogers Works of the American Locomotive Company, instead of eight, as reported in our issue of April 14.

The Pennsylvania is reported to have ordered 15 locomotives from the Allegheny Works and 15 from the Schenectady Works of the American Locomotive Company.

The Western Maryland is reported to have ordered 18 consolidation (4-6-0) passenger locomotives, and three switching (0-6-0) locomotives from the Baldwin Works for September 1 delivery.

The St. Louis & San Francisco is reported to have ordered 20 ten-wheel (4-6-0) passenger and freight locomotives from the American Locomotive Company, and 10 switching (0-6-0) locomotives from the Baldwin Works, both orders for July delivery.

The Illinois, Iowa & Minnesota, as reported in our issue of April 7, has ordered two compound mogul (2-6-0) freight locomotives from the Brooks Works of the American Locomotive Company for July delivery. These locomotives are to weigh 146,000 lbs., with 126,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 56 in.; radial stayed wagon top boiler, with a working steam pressure of 200 lbs.; 272 tubes, 2 in. in diameter and 12 ft. 1¼ in. long; homogeneous steel fire-box, 108 in. x 46 in.; tank capacity, 6,000 gal., and coal capacity, 10 tons. The special equipment will include: Westinghouse American air-brakes, sectional magnesia boiler lagging, National hollow brake-beams, Tower couplers, Nathan Monitor (No. 9) injectors, Leach (A-15) sanding devices, and Nathan bull's-eye sight feed lubricators.

The Illinois Central, as reported in our issue of April 14, has ordered 25 simple consolidation (2-8-0), and 10 simple switching (0-6-0) locomotives from the American Locomotive Company. The consolidation locomotives will weigh 203,000 lbs., with 183,000 lbs. on drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 63 in.; radial stayed extended wagon-top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,946 sq. ft.; 344 tubes, 2 in. in diameter, and 15 ft. 6⅜ in. long; Otis steel firebox, 108 in. x 68 in.; grate area, 50 sq. ft.; tank capacity, 7,000 gal., and coal capacity, 15 tons. The switching locomotives are to weigh 123,500 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 51 in.; radial stayed straight top boiler, with a working steam pressure of 200 lbs.; heating surface, 971 sq. ft.; Otis steel firebox, 60 in. x 68 in.; grate area, 27 sq. ft.; tank capacity, 4,500 gal., and coal capacity, 6½ tons.

The Chesapeake & Ohio, as reported in our issue of April 14, has ordered 18 simple consolidation (2-8-0) class G-7 locomotives from the American Locomotive Company. These locomotives are to weigh 186,600 lbs., with 165,575 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 56 in., with 50-in. wheel centers; extended wagon-top boiler, with a working steam pressure of 200 lbs.; 370 Shelby steel tubes, 2 in. in diameter and 14 ft. 9 in. long; firebox, 90 in. x 75 in.; tank capacity, 6,000 gal., and coal capacity, 10 tons. The special equipment will include: Westinghouse American air-brakes, Golmar bell ringers, Franklin magnesia boiler lagging, Monarch brake-beams, steel brake-shoes, Tower pocket attachment pilot couplers, Climax or R. E. Janney tender couplers, Hancock injectors, Jerome piston rod and valve rod packings, Consolidated safety valves, Leach sanding devices, Nathan bull's-eye triple sight feed lubricators, Railway Steel-Spring Co.'s springs, Latrobe driving wheel tires, Railway Steel-Spring Co.'s truck wheel tires, and 700-lb. cast-iron tender wheel tires.

CAR BUILDING.

The Canadian Northern has ordered 10 passenger cars from Barney & Smith.

The Tennessee Central is reported to be building a number of freight cars.

The Nashville, Chattanooga & St. Louis is reported to be building a number of freight cars.

The Naugatuck Chemical Company has ordered five acid tank cars from the Bettendorf Axle Company.

The Colorado & Southern has ordered six passenger cars from the Jeffersonville Works of the American Car & Foundry Company.

The Atchison, Topeka & Santa Fe is reported to have ordered 500 additional freight cars from the Standard Steel Car Company.

The Maine Central, as reported in our issue of April 14, has ordered 40 Hart convertible ballast cars which are to be built at the Detroit Works of the American Car & Foundry Company.

The Keystone Coal & Coke Company, of Philadelphia, has ordered 500 Pennsylvania Railroad standard class G1a steel coal cars of 100,000 lbs. capacity, to weigh about 40,000 lbs., from the Standard Steel Car Co., for August to September delivery.

The Illinois Central has ordered 600 box cars of 80,000 lbs. capacity for delivery during the months of August and September. These cars are to weigh about 39,000 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements.

The Merchants Despatch Transportation Company, as reported in our issue of April 14, has recently built at its Despatch shops 750 refrigerator cars of 60,000 lbs. capacity, and is now building 150 additional. These cars are 35 ft., 2¼ in. long, 8 ft. 4 in. wide, and 7 ft. 7⅝ in. high, all inside measurements.

The Detroit Southern, as reported in our issue of April 14, has ordered 200 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will weigh 22,000 lbs., and measure 40 ft. long and 9 ft. wide. The special equipment will include: Damascus brake-beams, Westinghouse air-brakes, Fulton brasses, Monarch couplers, Miner tandem draft rigging, Symington journal boxes and lids, Standard Steel Co.'s springs and Diamond arch-bar trucks.

BRIDGE BUILDING.

BATON ROUGE, LA.—The Southern Pacific, Illinois Central and the St. Louis & San Francisco, are said to be considering a joint bridge over the Mississippi River.

CLEVELAND, OHIO.—Bids are wanted April 29, at the office of the Board of Commissioners for building concrete and stone culverts and abutments and retaining walls in Cuyahoga County. Julius C. Dorn, County Clerk.

DENVER, COLO.—Bids are wanted at the office of the Board of Public Works, April 26, for building a Milan reinforced concrete arch over the Platte river on West Colfax avenue. G. E. Randolph, President.

GREENWOOD, ARK.—Bids are wanted May 1, by Wm. A. Falconer, County Judge, for building two steel bridges 56 ft. each over James Fork in Sebastian; also for building one steel bridge 80 ft. long, with two approaches of 32 ft. each, over Vache Grasse Creek in Sebastian County.

KITTANNING, PA.—Bids are wanted April 27 by the County Commissioners for the stone abutments and iron superstructure of a bridge to be built over Garrett's Run in Armstrong County. Benjamin Oswald is clerk.

MINNEAPOLIS, MINN.—Contract is reported let by the Canadian Pacific to Grant Smith & Company of this place for the bridge work on the Emerson, Prince Albert and Portland sections of its road, and to Kelly Bros., of Shane, for the arches and culverts on the Ignace, Rat Portage, and La Riviere sections.

MONTCLAIR, N. J.—Plans are being made for abolishing the Delaware, Lackawanna & Western grade crossing over Bloomfield avenue. A steel or concrete viaduct is proposed, to carry highway and electric car traffic, and to cost about $30,000.

NEW YORK, N. Y.—Only two bids were submitted for improvements at the Manhattan end of the Brooklyn Bridge terminal, that of the Snare & Triest Co., $102,600, and the Northeastern Construction Co., $145,000. Contract reported let to Snare & Triest.

The bids opened by Bridge Commissioner Best for completing the University Heights bridges and approaches over the Harlem River from 217th street, Manhattan, to 184th street in the Bronx, were Snare & Triest, $595,897; Williams Engineering & Construction Co., $609,696; J. C. Rodgers, $633,518; United Engineering & Constructing Co., $638,566; Naughton & Co., $644,414; Gallo & Pitteli, $671,002, and R. H. Hood Company, $809,828. Contract reported let to Snare & Triest.

RAT PORTAGE, ONT.—Bids are wanted by D. H. Currie, Clerk, for building a steel bridge across the tracks of the Canadian Pacific Railway on Julius street.

SAVANNAH, MO.—Bids are wanted May 4, by J. E. Schnitzins, Road and Bridge Commissioner, for some bridge work in Andrews County.

STILLWATER, OKLA.—Bids are wanted May 8, by J. H. Donart, County Clerk, for building 19 steel bridges, each from 30 ft. to 70 ft. in length, in Payne County.

SYRACUSE, N. Y.—Bids are wanted April 19, by Superintendent of Public Works at Albany, for building the superstructure of the Willis street bridge over the Oswego canal.

TORONTO, ONT.—Bids are wanted April 24, by J. W. Leonard, construction manager for

the Canadian Pacific, for bridges on the Toronto-Sudbury branch from Bolton to Parry Sound. Plans at 112-118 King street west.

The city engineer has submitted to the Board of Control the plans for the proposed tunnel under the bay from the island to the city and bids will be asked for at an early date.

Other Structures.

ALLEGHENY, PA.—A resolution has been passed by the Council giving authority to the Pennsylvania to use Federal street as a site for a new passenger station, described elsewhere in this issue.

BATTLE CREEK, MICH.—The Grand Trunk, it is reported, has commenced work on a new passenger station to cost $100,000, and is planning to build large new car shops east of the station.

CARNEGIE, PA.—The Pennsylvania will build a new brick freight house, duplicating the capacity of the present structure.

GALVESTON, TEXAS.—The Southern Pacific, it is reported, has authorized an expenditure of $35,000 to build an additional shed on the west side of the present shed at pier B. The company is making a number of improvements, including buildings and new trackage and filling in low lands. Among the buildings is a 10-stall roundhouse of brick, a store office building 20 ft. x 60 ft., and a 20 ft. x 30 ft. blacksmith shop.

LOUISVILLE, KY.—The L. & N., it is said, has given a contract to Geo. E. Gary, of Hopkinsville, Ky., to build a freight house to cost $18,000.

NEWARK, OHIO.—Local reports say that improvements to cost $50,000 will be made by the Baltimore & Ohio at its shops here.

READING, PA.—The Philadelphia & Reading is making improvements at its shops here to include the following: Manufacturing tool room, a one-story brick structure 23 ft. wide by 63 ft. long, with hook tile and slag roof, built to the west side of the machine shop; tool storage room, a one-story brick structure 23 ft. wide by 83 ft. long, with hook tile and slag roof, built to the west side of the machine shop; test room and general foreman's office, a one-story brick structure 23 ft. wide by 40 ft. long, with hook tile and slag roof, built to the west side of the machine shop; extension to boiler shop, a one-story and two-story brick structure 119 ft. wide by 223 ft. long, with steel skeleton frame, brick walls and slag roof, this extension to be provided with one 10-ton and one 35-ton electric cranes.

VALLEY JUNCTION, IOWA.—The Chicago, Rock Island & Pacific, it is said, has given contracts to Pennsylvania firms for supplying it with $37,000 of new shop machinery for its shops here. The machinery is to be delivered before September 1, and will be placed in the new additions which the company will build this summer. The company also intends to put up a brick fifty-stall round-house, besides additions to the machinery shops, car shop building and new office building.

WAYCROSS, GA.—The shops of the Atlantic & Birmingham, it is reported, were recently damaged by fire at a loss of about $50,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALEXANDRIA, BAYOU MACON & GREENVILLE.—An officer writes that a tax has been voted for ten years by West Carroll Parish, La., in aid of this road. Preliminary work on the line has been under way for the past year, and it is planned to soon begin the construction of the road. J. D. Garrison, Chief Engineer, Delhi, La. (See Construction Record.)

ATCHISON, TOPEKA & SANTA FE.—According to reports the Abo Pass cut-off, which this company will build at a cost of $10,000,000, will enable the road to avoid heavy mountain grades and reduce running time of trains seven to ten hours. It will extend from Belen, N. Mex., to Texico, on the line between Texas and Mexico, 250 miles. Construction was commenced two years ago, but discontinued after 22 miles of track were laid. Work will shortly be resumed and completed in 15 months. At Texico the line will connect with the Pecos Valley line of the Atchison system. It will cross the Santa Fe Central at Willard and connect with the El Paso & Northeastern at Llano. The mountains will be crossed at Abo Pass at an altitude at summit of 6,491 ft. The heaviest grade westbound in crossing the mountains will be 0.6 per cent., while eastbound the heaviest grade will be 1.25 per cent. for a distance of 30 miles. The present route of the Atchison over the Sierra Nevada mountains has grades of 3.50 per cent.

BALTIMORE & OHIO SOUTHWESTERN.—An officer writes that this company is not contemplating any improvements in Cincinnati, but intends to extend its present second track which terminates at Madeira to O'Bannon, 8.61 miles. The total curvature at present is 455½ deg. and on the reconstructed line will be only 334 deg., a saving of 121½ deg. The present maximum grade is 1.012 per cent., but it is not uniform. On the new line the maximum grade will be the same, but it will be uniform over the given distance, and will practically all be on tangent. There are no important towns between Madeira and Loveland, and the work will be done on the present right of way. The only important bridge work will be that over the Miami river, which will have to be converted from a single to a double-track bridge.

BOYNE CITY, GAYLORD & ALPENA.—This company has been incorporated in Michigan, with a capital stock of $1,000,000, to take over the property of the Boyne City & Southeastern, and extending the line from Boyne City to Alpena, a distance of about 110 miles. A map showing the location of its proposed line to Gaylord with crossing of the Grand Rapids & Indiana and the Michigan Central railroads, has been filed. The directors are: William H. White, Thomas White, James A. White, Robert V. White, William L. Martin, J. K. V. Agnew and J. M. Harris, all of Boyne City.

BREMEN & SOUTHWESTERN.—This company has been incorporated in Alabama to build a line from Bremen, Ga., to Wedowee, in Randolph County, Ala. Connection will be made with the Central of Georgia and the Southern at Bremen. The incorporators include H. W. Gardner, L. B. Parker and A. A. Hurst.

CACAHUAMILPA CAVES EXPLORATION COMPANY.—This company has been organized in Mexico City, with a capital of $400,000, to develop and exploit extensive deposits of fine marble and to build a railroad from Cacahuamilpa to the Hermosa station of the Cuernavaca division of the Mexican Central. The officers are: Señores Carlos Bach, President; Emilio Leycegui, E. Fernandez Castelló, Javier Morales Cortazar, Lic. Gomez Perez and Jose Nozari.

CATOCTIN & PEN-MAR (ELECTRIC).—At a recent meeting of the incorporators of this company which was granted a charter last year in Maryland, it was decided to build. The proposed route is from Wolfsville to Highfield, on the Western Maryland, and thence to Pen-Mar, about 21 miles. Surveys completed show that the road can be built without any grades in excess of 4 per cent. Nearly all of the right of way has been secured.

CHESAPEAKE & OHIO.—Contract is reported let to S. T. Smith, of Richmond, Va., to double-track this road from Dayton, Ky., to Silver Grove, 10 miles. The cost of the work will be about $500,000.

CHICAGO & NORTHWESTERN.—Surveys are reported being made by this company for a branch line from Rockford, Ill., by way of Stillman along the east side of Rock river to Dixon, 40 miles.

CHICAGO, KANKAKEE & CHAMPAIGN (ELECTRIC).—This company has been incorporated in Illinois, with a capital of $100,000, to build an electric road from Champaign, Ill., in a northerly direction through the counties of Champaign, Iroquois and Kankakee to Kankakee, and then northeasterly through the counties of Will and Cook to Chicago. The incorporators and first board of directors are: E. D. Risser, R. A. McCracken, of Paxton, Ill.; Upton Schaub, of Watseka, Ill., and C. V. Donovan, C. C. Patton and W. J. Boot, of Chicago.

CHICAGO, ROCK ISLAND & PACIFIC.—The work let to the Dalhoff Construction Co., of Little Rock, Ark., on the extension of this road from Traskwood to Crossett, Ark., about 107 miles, on the main line, and 36 miles on the branch road from the main line to Eldorado, Ark., has been sublet. Some of the sections have been let to John Currous, W. P. Fitzgerald, S. T. Watson, Cahill Bros., A. G. Brown & Co., Grigsby, Seger & Atkinson Construction Co., and Adams & Peters.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Surveys are reported made and rights of way secured by this company for a new line to be built from Danville, Ill., to Indiana Harbor, crossing the Indianapolis line at St. Anne. By this route the C., C., C. & St. L. will parallel the tracks of the Chicago & Eastern Illinois from Danville to Chicago. From Indiana Harbor the road can use the tracks of the Lake Shore. The proposed line will be 125 miles long.

COLUMBUS & ANNISTON.—This company has filed a certificate of incorporation in Alabama, with a capital stock of $100,000, to build a road from Columbus, Ga., to Attalla, Ala. The incorporators include Frank G. Lumpkin, E. H. Hardaway, Howell Hollis and E. K. Cargill, all of Columbus, Ga.

COLUMBUS & LAKE MICHIGAN.—During the coming summer this company, which operates a line from Lima to Defiance, Ohio, 42 miles, will, it is reported, be extended from the former place to West Mansfield, about 40 miles.

DAYTON & NORTHEASTERN (ELECTRIC).—Incorporation has been granted this company in Ohio with a capital of $100,000 to build an electric road from Dayton to Kenton, 75 miles, passing through Montgomery, Miami, Clark, Champaign, Logan and Hardin Counties. The incorporators are: Hugo Cook, W. W. Chambers and others, of Dayton.

DELAWARE INTERURBAN (ELECTRIC).—An officer writes that this company is building with its own forces an electric road from Wilmington, Del., via Marshallton and Newark to Elkton, Md., 19½ miles, which it expects to have finished by September of the present year. The work includes the building of a few small bridges which have not yet been ordered. H. R. Fothergill is Chief Engineer, Gowthrop Building, Wilmington, Del.

ERIE.—This company has submitted to the Jersey City Street and Water Board its plans for the proposed improvement of its terminal. The plans provide for 550 ft. of tunnel and an open cut through the Heights for the passenger trains. At the westerly end the trains will run under the tracks of the Lackawanna Railroad. There will be four passenger tracks. The tracks will run on an elevation in the city east of the tunnel to the new station and ferry-house, to be erected at 11th street, three blocks above the present station. A roundhouse is provided for at 12th and Brunswick streets. The present tunnel will be used for freight trains. The company has bought a large tract of land, and asks the city to vacate north of its line 11th and 12th streets for two blocks, from Monmouth street to Division street, at the western mouth of the tunnel, and the three blocks between Monmouth and Brunswick streets, from 13th street north to 16th street, all on the meadows; also for the vacation of tracts at Barnum street and at Ninth street. In exchange for these vacations it will give the city certain privileges, and will widen Hoboken avenue on the Heights.

GRAND RAPIDS, BELDING & GREENVILLE (ELECTRIC).—Articles of incorporation have been filed by this company in Michigan, with a capital stock of $60,000, to build a line from Saranac to Greenville, about 19 miles. The board of directors includes John T. Rich, J. L. Rich, J. L. Hudson, Edward Holmes,

John P. Hopkins and E. M. Hopkins, of Detroit; C. H. Pomeroy, Saginaw; Frank Wescott, Vernon, and M. D. Sly, Romeo.

HAVANA CENTRAL.—This company has been incorporated in New Jersey with a capital of $5,000,000 to build and operate railroads in Cuba. The incorporators include Frank J. Hammer and John J. Cleary, of Brooklyn, N. Y.; Henry M. Traphagen, of Jersey City; Benson S. Currier and Chauncey Blair Spears, of New York.

HOUSTON EAST & WEST TEXAS (SOUTHERN PACIFIC).—Surveys, it is reported, have been completed from Shreveport as far as Hope, on the proposed line to be built to Hot Springs. This road has been under consideration for some time and the preliminary surveys are said to indicate a successful carrying out of the project.

KENTUCKY ROADS.—The Louisville Property Co., which is supposed to be backed by the Louisville & Nashville, is reported as securing rights of way to build a road from Jellico up Greasy creek to Four Mile, a station near Pikeville, Ky., 40 miles. The line will reach coal fields.

LAKE SHORE & MICHIGAN SOUTHERN.—Rights of way, it is reported, have been secured by this company as far as Brookville for an extension from Franklin, Pa., up Mill Creek through Allen's Mills to Falls Creek, where connection will be made with the B., R. & P.

LOUISIANA & PINE BLUFF.—This company has been incorporated in Arkansas with a capital of $300,000, all subscribed, to build a road from Huttig, Union County, to Wilmington, in the same county, 25 miles. The corporators are C. D. Johnston, E. A. Frost, F. W. Scott, A. W. Corkins and R. E. Rowland. The line will cross the Iron Mountain at a point near Huttig.

LOUISVILLE & NASHVILLE.—This company, on April 13, opened its line between Jellico and Knoxville, Tenn., 65 miles. This completes the Atlanta, Knoxville & Cincinnati division, and the Louisville & Nashville now has a through route from Cincinnati to Atlanta by way of Paris, Richmond, Livingston, Knoxville and Marietta.

Contract is reported let by this company to Edington Griffitts & Co., of Knoxville, for building its line between Saxton and Corbin, Kentucky. The contract calls for the construction of from 12 to 15 miles of grading work in the line 32 miles long through a mountainous district. The contractors have been given one year in which to finish the work and will sublet some sections.

LUXORA, JONESBORO & WESTERN.—A new company has been incorporated in Arkansas with a capital stock of $500,000, of which $90,000 has been subscribed, to build a road from Luxora, Mississippi County, to Jonesboro, Craighead County, 45 miles. The corporators are C. T. Burns, R. McCreey, of Black Rock; John Driver, R. T. Woodson and W. B. Calhoun, of Luxora; D. H. Robertson, of Lake City, and E. L. McHaney, of Little Rock. The company is chartered to build either a steam or electric line. The proposed route will parallel the Jonesboro, Lake City & Eastern from Lake City to Jonesboro and other roads in that section.

MANUFACTURERS' BELT LINE.—This company has been incorporated in Indian Territory with a capital stock of $500,000. The incorporators are: M. B. Baird, M. C. Hale, and H. C. Stebbins, of Tulsa, and Major Moberly and Howard Elder, of Oklahoma City. The company proposes to build a railroad from a point on the Midland Valley in the Cherokee nation to Tulsa, then, in a circle around that place, the diameter of the circle not to exceed six miles, to the coal banks near Dawson, Ind. T.

MARQUETTE & SOUTHEASTERN.—Announcement has been made that this road, which is controlled by the Cleveland Cliffs Iron Co., will be extended north of Marquette, Mich., to Big Bay, 25 miles. Surveys are reported made and contracts for grading and track laying will shortly be let. The extension will pass through a rich timber country and will be used principally for logging purposes. The company, which has a capital of $300,000, has bought 20,000 acres of land and will at once begin erecting sawmills. A number of Pennsylvania capitalists are interested; also W. F. McKnight, of Grand Rapids, and Rush Culver, of Marquette, who will be General Manager.

NEEDLES, SEARCHLIGHT & NORTHERN.—Under this name a line is to be built from Ibex, Cal., on the main line of the Atchison, Topeka & Santa Fe, to the mining district at Searchlight and Eldorado Canyon, Nev., about 23 miles.

NEW YORK, NEW HAVEN & HARTFORD.—The line running through Needham, Mass., a part of the Midland division, is to be connected at its eastern end with the Providence division, by a line to be built from Needham to Spring street, West Roxbury, about four miles. The cost of the new line will be about $650,000. The trains of the Needham line now run over the Boston & Albany, between Newton Highlands and Boston.

A contract is reported let by this company for laying two additional tracks from Guilford, Conn., to East River about two miles. Edward Gagel is the engineer in charge of the work.

NORTHERN PACIFIC.—Plans are reported made for building an extension on the McHenry branch from McHenry, N. Dak., through the Fort Totten Indian Reservation to Oberlin, 40 miles, connecting at that point with a branch to Esmond. Rights of way have not yet been secured and the company intends to build only as far as the Cheyenne river during the present season.

PANAMA RAILROAD.—At the annual meeting at the offices of this company, 21 State street, New York, the board ordered that the entire road be doubled-tracked at once and that entirely new equipment throughout be purchased, as recommended by Vice-President J. F. Wallace, after a personal examination of the property. The board appropriated $1,250,000 out of the company's surplus funds for these purposes.

PARRAL & DURANGO.—This company, which operates about 80 miles of road, is planning to at once build an extension from its southern terminus to Gunacevi, in the State of Durango, 50 miles, and it is said the road will eventually be extended to the Pacific coast, 150 miles further. The company is owned by a syndicate of Pittsburg capitalists. President, S. E. Gill, Pittsburg, Pa.

PENNSYLVANIA LINES WEST.—An officer writes that work has been commenced on the Indianapolis Division laying second track from Woodstock to Urbana, a distance of about 15 miles. Contracts have been let for the grading and masonry to Moran & Hassett, of Pittsburg, and the T. A. Gillespie Company, of Pittsburg. The grades will be reduced from a maximum of .9 per cent. to .7 per cent. Twelve small bridges will be extended. The maximum curvature of this part of the line is now 2 deg.

PINE BLUFF NORTH & SOUTH.—A company under this name has been incorporated in Arkansas with a capital stock of $600,000, of which $92,000 has been subscribed, to build a road from Pine Bluff, Ark., to Lonoke, 46 miles. The corporators include E. C. Howell, William Nichols, W. N. Trulock, C. S. Bacon and E. B. Bloom.

PORT ARTHUR & HOUSTON SHORT LINE.—An officer writes that bids for the construction work on this proposed line are being asked for. The proposed route runs from Port Arthur to Houston, Texas, 85 miles, through a rich country easily tilled and of great value, touching Wallisville, the county seat of Chambers County. It will provide a short connection between Houston and Port Arthur. The construction work will be pushed as rapidly as possible to have the road in operation within a year. Financial arrangements are nearly completed and engineers are now making surveys. The line will be operated by steam and will be level nearly all the way. There will be four steel bridges and two draw bridges. F. J. Hart, 507 Missouri Trust Building, St. Louis, Mo., is President.

SIOUX CITY, HOMER & SOUTHERN.—Surveys, it is reported, are being made by this company to build in Nebraska from Homer to Omaha, passing through the Winnebago reservation, about 80 miles. It is proposed to use gasoline motors.

TORRANCE, ROSWELL & GULF.—Maps have been filed by this company in New Mexico, showing the route of this proposed road from Torrance southeast to a point north of Roswell, then 30 miles south to township 10, through sections 5, 8 and 17, to the middle of section 20. The officers are: William H. Andrews, of Albuquerque, President; Frances J. Torrence, of Pittsburg, Pa., Vice-President; Willard S. Hopewell, of Hillsboro, Second Vice-President; T. Lee Clark, of Allegheny county, Pa., Treasurer; W. C. Hagen, Secretary; Arthur Kennedy, of Pittsburg, Director.

VANCOUVER, VICTORIA & EASTERN.—Application has been made to the Dominion Parliament for permission to build a line from Ladner, B. C., to the south bank of the Fraser river near Liverpool, and to connect with a bridge over the Fraser river near New Westminster, about 15 miles. J. J. Hill, President of the Great Northern, is said to be back of this project.

WESTERN MARYLAND.—An officer of this company is reported as saying that the work of double-tracking the road from Hagerstown to Baltimore will soon be commenced. Surveys for the work have been made, many curves will be taken out and grades reduced.

RAILROAD CORPORATION NEWS.

ANN ARBOR.—It is reported that Eugene Zimmerman, President of the Cincinnati, Hamilton & Dayton Pere Marquette System, and member of the syndicate which expects to purchase the Detroit Southern when it is offered at foreclosure sale on May 1, has bought the Ann Arbor Railroad & Steamship lines. A consolidation of the Ann Arbor and the Detroit Southern would give a road with 714 miles of line running from Ironton, on the Ohio River, through a connection between the two roads at Dundee, Mich., about half way between Detroit and Toledo, to Frankfort on the north end of Lake Michigan. The Ann Arbor runs a car ferry from Frankfort to Menominee and Manistique, Mich., and Manitowoc and Kewaunee, Wis. The Ann Arbor Railroad runs from Toledo, Ohio, to Frankfort, Mich., 292 miles.

ARKANSAS SOUTHERN.—This company is reported to have bought the Louisiana & Northwest which runs from McNeil, Ark., to Natchitoches, La., 122 miles. The Arkansas Southern line runs from Eldorado, Ark., to Winnfield, La., 99 miles, parallel to the Louisiana & Northwest.

BOSTON ELEVATED.—The Massachusetts Railroad Commission has authorized an issue of $7,500,000 30-year 4 per cent. bonds. These bonds are part of an authorized issue of $11,000,000 and are to provide for an extension of 2½ miles to Forest Hills, and for a new power station, terminal stations, and rolling stock, including equipment for the East Boston tunnel.

BROOKLYN RAPID TRANSIT.—This company's statement for the year ending Dec. 31, shows gross earnings of $15,459,660, net earnings of $6,434,885, and net income of $1,473,271.

CHICAGO & SOUTH SHORE (ELECTRIC).—By a decree of the Federal Court in Indianapolis, this electric road which runs from La Porte, Ind., to Michigan City, 14 miles, is to be sold at foreclosure sale. The company has bonds outstanding to the amount of $362,000.

CHICAGO, ROCK ISLAND & PACIFIC.—The $7,000,000 first and refunding mortgage gold bonds of 1934, recently sold to Speyer & Co., are reported to have been resold to German banks for official issue in the German markets. One-half of the $7,000,000 will be issued at once, the proceeds to be used principally to pay for the large amount of equipment which will be received during the year. The new bonds are in addition to the $25,558,000 already listed on the New York Stock Exchange.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—The directors of this company have recommended an increase of $11,300,000 in the capital stock, the new issue to be all common stock, and $5,600,000 to be offered to stockholders at par to the extent of 20 per cent. of their holdings. The proceeds of this amount are to be used for improvements and not for the acquisition of other properties. The remaining $5,700,000 will be held in the treasury to be issued as needed. The total issue of common stock at present is $28,700,000, and with the new issue it will be $40,000,000. A special meeting of the stockholders will be held in Cincinnati May 31 to act upon the proposed increase.

The report for the six months ended Dec. 31, 1904, issued in consequence of the change in the fiscal year of all Vanderbilt lines, shows gross earnings of $12,141,288, an increase of $1,071,156 over 1903. Net earnings were $3,951,394, an increase of $897,066. The operating ratio was 67.4 per cent. in 1904, and 72.3 per cent. in 1903. Of the $1,125,943 surplus remaining after the payment of interest, taxes and dividends on the preferred and common stocks, $1,000,000 was carried to the equipment renewal fund, and $30,991 charged to adjustments, leaving $94,952 carried over to profit and loss, which makes that item show a total of $1,652,735. During the year $3,498,176 was spent on double track work, and $1,549,375 on new equipment, of which $1,821,430 was paid for locomotives, $466,893 for freight cars, $214,239 for coal cars, and $46,813 for passenger cars.

COLORADO & SOUTHERN.—This company has acquired control of the Colorado Springs & Cripple Creek District Railway, and of the Trinity & Brazos Valley which runs from Cleburne, Texas, 30 miles south of Fort Worth, southeast to Mexica, 78 miles. The latter line is to form a part of the projected extension from the terminus of the Fort Worth & Denver City at Fort Worth, to the Gulf of Mexico.

COLORADO SPRINGS & CRIPPLE CREEK DISTRICT.—See Colorado & Southern.

DETROIT SOUTHERN.—Notice has been given that over 85 per cent. of the stock has been deposited under the plan of reorganization and that the final day on which deposits will be received is April 24.

FORTY-SECOND STREET, MANHATTANVILLE & ST. NICHOLAS AVENUE (NEW YORK CITY).—Application has been made to the Supreme Court of New York State for the appointment of a receiver for this street railroad, and for an injunction restraining the New York City Railway from continuing to operate the road. It is claimed that earnings which should have been applied to the payment of interest on the second mortgage 6 per cent. income bonds have been used for other purposes. There are $1,500,000 of these bonds outstanding, of the authorized issue of $1,600,000, and the Union Trust Company, as trustee under the mortgage, has made the application on behalf of holders of a large amount of them. President Vreeland, of the New York City Railway, has made an affidavit denying that any surplus has been earned available for interest.

GREAT NORTHERN.—This company's statement for the month of March shows approximate gross earnings of $3,419,705, an increase of $378,071 over 1904. For the nine months ended March 31, gross earnings were $33,326,384, an increase of $1,402,744 over the previous year.

HAVANA ELECTRIC.—This company has had listed on the New York Stock Exchange, $6,957,000 consolidated mortgage 5 per cent. bonds of 1952, $5,000,000 6 per cent. non-cumulative preferred stock, and $7,500,000 common stock. The bonds are part of an authorized issue of $10,000,000 of which $1,291,600 will be reserved for refunding purposes.

LAKE ERIE & WESTERN.—As a result of the unification of the Vanderbilt system, the Lake Erie & Western will abandon six miles of its line from Connersville, Ind., north to Beeson's, and will use the Cleveland, Cincinnati, Chicago & St. Louis tracks between these points.

LANSDALE & NORRISTOWN (ELECTRIC).—The foreclosure sale of this company, which operates 12½ miles of line in Norristown, Pa., has been ordered for May 4, the minimum acceptable price to be $150,000. The company issued bonds to the amount of $299,000 in April 1, 1902, on which no interest has been paid.

LEHIGH VALLEY.—The National Docks Railway Co., which operates a line from a connection with the Lehigh Valley at Jersey City to Constable Hook, two miles, with seven miles of branches, has been consolidated with the Lehigh Valley Railroad Co., of New Jersey, which is controlled by the Lehigh Valley through ownership of its entire capital stock. This was increased by $3,854,000 in order to exchange this amount for stock of the National Docks Company at par. This makes the total capitalization of the Lehigh Valley R. R. Co., of New Jersey, $20,308,000.

LOUISVILLE & NASHVILLE.—Henry B. Gray, of Birmingham, Ala., who recently secured an injunction restraining the Louisville & Nashville from absorbing the South & North Alabama by buying the stock at $27.50 a share, has made an offer to buy all of the stock of the South & North Alabama at par. There is $3,400,000 of stock outstanding.

LOUISIANA & WESTERN.—See Arkansas & Southern.

MILLEN & SOUTHWESTERN.—This company, whose road runs from Millen, Ga., to Vidalia, 53 miles, has authorized an issue of $800,000 first mortgage 5 per cent. bonds of 1955. Of this amount $210,000 ($4,000 per mile) is to be issued at once; $1,000 per mile is to be reserved for betterments, and $5,000 per mile for extensions.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Wm. A. Read & Co., of New York, have recently offered at 100½, $250,000 first consolidated 4 per cent. gold bonds of 1938 of this company, interest guaranteed by the Canadian Pacific.

NEW YORK CENTRAL & HUDSON RIVER.—The statement of this company and leased lines for the month of March shows earnings from operation of $7,003,296 in 1905, against $6,460,258 in 1904, an increase of $543,038. For the quarter ended March 31, earnings from operation increased $1,211,636 from $17,231,453, last year, to $18,443,089, this year.

This company has applied to the New York Stock Exchange to list $30,000,000 of its 4 per cent. debenture bonds, authorized in 1904. This is the unissued part of the authorized issue of $50,000,000. The proceeds are to be used chiefly for improvements.

NEW YORK, NEW HAVEN & HARTFORD.—Governor Douglas, of Massachusetts, has signed a bill providing for the purchase of the New England by the New York, New Haven & Hartford.

In a hearing before the Massachusetts Railroad Commission it came out that the Consolidated Railway paid $1,500,000 for the Worcester & Southbridge Street Ry., which connects Worcester, Mass., with Southbridge, Sturbridge and Fiskdale. At the time the latter road was taken over, it was in the hands of a receiver with a floating debt amounting to $880,000. In order to avoid assuming this amount, holders of its $600,000 stock were willing to turn their stock over to the Consolidated Co. for nothing. The $1,500,000 paid represents, in addition to the floating debt, the bonds on the property. The Worcester & Southbridge has retired $680,000 of its floating debt, and a new issue of $100,000 bonds has been made.

PENNSYLVANIA COMPANY.—The Guaranty Trust Co., of New York, has recently offered at 93¼ and interest, a block of this company's 3½ per cent. 40-year Series D guaranteed trust certificates. They are secured by a deposit at par of 7 per cent. special guaranteed stock of the Pittsburg, Fort Wayne & Chicago, all of whose outstanding bonds by the operation of the sinking fund will be extinguished on July 1, 1912.

ROCHESTER & EASTERN RAPID.—This company has recently been purchased, probably by the Westinghouse interests, and the new owners have bought the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co.'s line which runs from Geneva, N. Y., to Cayuga Lake Park, 17 miles.

ST. LOUIS & SAN FRANCISCO.—Press reports state that this company will shortly take over the Tennessee Central, which runs from Hopkinsville, Ky., through Nashville to Harriman, Tenn., 50 miles east of Knoxville, 251 miles of main line, with 47 miles of branches and a belt line 11 miles long about the city of Nashville, which includes all the river front at that place and branches to all the manufacturing districts of the city. It is probable that if the "Frisco" acquires the road, a connection will be built between Joppa, Ill., or Evansville, Ind., on the Chicago & Eastern Illinois, and Hopkinsville, the northern terminus of the Tennessee Central.

This company's statement for the eight months ending Feb. 28, shows gross earnings of $26,086,562 in 1905, against $24,624,150 in 1904, an increase of $1,462,412, and net earnings of $8,831,474 in 1905, against $8,132,645 in 1904, an increase of $698,829.

SOUTHERN PACIFIC.—See Texas & New Orleans.

TENNESSEE CENTRAL.—See St. Louis & San Francisco.

TEXAS & NEW ORLEANS.—Governor Lanham, of Texas, has approved the bill authorizing this company, controlled by the Southern Pacific, to sell its Dallas-Sabine Division which runs from Dallas, Texas, southeast to Sabine Pass, on the Gulf of Mexico, 280 miles, to an independent company not to be identified in any way with the Southern Pacific. At present the Southern Pacific controls parallel routes between those points.

TEXAS & PACIFIC.—This company is reported to have bought control of the Natchez & Western which operates a narrow gage line from Vidalia, La., opposite Natchez, to Black River, 25 miles. It is probable that the line will be changed to standard gage and extended to a connection with the Texas & Pacific, New Orleans & Northwestern and Memphis, Helena & Louisiana at Faraday, La.

TOLEDO, ST. LOUIS & WESTERN.—Wm. A. Read & Co., of New York, have recently offered at 90⅛ and interest, $250,000 of this company's prior lien mortgage 3½ gold bonds of 1925.

TRINITY & BRAZOS VALLEY.—See Colorado & Southern.

VERA CRUZ & PACIFIC.—This company has applied to the New York Stock Exchange to list $7,000,000 first mortgage 4½ per cent. bonds.

WABASH.—Notice has been given to the holders of the debenture "B" bonds that the bondholders' agreement of March 27, for the purpose of securing an adjustment of the claims for interest, has become effective by the execution thereof by the owners of the requisite number of bonds. Any additional bondholders desiring to join in the proceedings are requested immediately to sign the agreement, copies of which may be obtained at the office of the United States Mortgage & Trust Company of New York.

WALLKILL TRANSIT COMPANY.—This company has recently been organized at Middletown, N. Y., and incorporated at Albany, with $350,000 authorized capital stock, as a successor of the Middletown-Goshen Electric Railway.

WASHINGTON, ALEXANDRIA & MT. VERNON (ELECTRIC).—Graham & Company of Philadelphia have recently offered at 102½ and interest a block of this company's first mortgage 5 per cent. gold bonds.